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VOL. XV FASC. 1 15: II 1934 N:o 83

# RÖNTGENOLOGICAL FINDINGS IN MALIGNANT TUMORS OF THE NASOPHARYNX[1]*

by

*Gunnar Jönsson*

(Tabulæ I—IV)

The clinical diagnosis of malignant tumors of the nasopharynx often causes great difficulty due to the shifting symptomatology and the fact that such a relatively large number, in the beginning, cause no trouble in the nasopharynx. A very important group — ZUPPINGER calls it the neurological group — gives no symptoms at all, before the tumor has extended beyond its primary situation and has invaded the nerves along the base of the skull or has penetrated the latter into the middle cranial fossa. These cases are often diagnosed as cerebral tumor or some other disease of the central nervous system. Especially in the latter but also in other cases, röntgen examination of the skull can contribute a great deal to the diagnosis.

It has long been known that malignant tumors of the nasopharynx can produce cranial nerve symptoms and that these symptoms may be the first the patient notices and that therefore the clinician must keep this possibility in mind in cases of trigeminal neuralgia, abducens paralysis, etc. (GARDHAM, JACOD, MARSCHLIK, OPPIKOFER, STÄHELI and others). In spite of this, the importance of a röntgen examination of the base of the skull was not pointed out until much more recently (SCHÜLLER, MAYER, ZUPPINGER). The cases examined by röntgen and reported in the literature are very few. The largest series have been published by ZUPPINGER who mentions that 10 of these presented neurological symptoms. However, further details of the röntgenograms in individual cases were not given.

[1] Read before the Northern Society for Medical Radiology, Stockholm, June 30, 1933.

* Submitted for publication 3. X. 1933.



HCB

During the last 3 years, 33 cases of tumors of the nasopharynx have been röntgen examined at the Serafimer Hospital. This is a relatively large number, when one considers the rarity of such tumors. Most of the cases have been sent to us from the Radiumhemmet, the others from the Serafimer Hospital.

The general aim of the examination has been to demonstrate possible areas of destruction in the base of the skull in cases where a tumor of the nasopharynx had already been clinically diagnosed, but sometimes in unclear cases it has been important to be able to examine the nasopharynx itself for tumor.

A complete examination of the skull has been made in all cases, but usually the changes could only be demonstrated on pictures taken with an axial direction of the beam. Since there are intracranial tumors which produce similar changes in the base of the skull, in order to avoid making a mistake it is necessary to do a complete examination of the skull, at least in cases not clinically clear. If there are symptoms indicating that the tumor is attached to the optic nerve or pressing into the orbit, special pictures must also be made of the optic canal and posterior portion of the orbit. (See fig. 3 d.)

In a number of rare cases of tumors of the nasopharynx there are symptoms from the 9th, 10th and 11th cranial nerves. The so-called jugular symptom may be due to direct pressure of a tumor extension under or in the base of the skull but, according to ZUPPINGER, it can also be due to lymph node metastases situated at the jugular foramen. Such metastases can produce isolated areas of destruction in this region. This area does not show up well on the usual axial films, so if the jugular syndrome is present, it is necessary to take the picture with special attention to the region of the jugular foramen. This is obtained by a set up which resembles the axial but differs from it in that the central rays form a 60° instead of a 90° angle with the line between the external auditory meatus and the infra-orbital margin.

In order to demonstrate the soft parts of the tumor itself, ZUPPINGER recommends the introduction of lipiodol or some opaque substance into the nasopharynx while the patient lies on his back with his head bent back. We have been satisfied with the contrast obtained from air in the nasopharynx. The contours of the nasopharynx and pharynx often show up extremely well on a usual axial view (Fig. 1). Normally one can see the transverse shadows of the base of the tongue and the soft palate. In order to diminish the inconvenience of this, one may have the patient hold his tongue forward in the mouth as far as possible or one may have him stick out his tongue during the exposure. Fig. 2 shows the same patient (a) when he puts out his tongue and (b) when he holds it far back in his mouth. If the findings on the axial picture are uncer-

tain, a lateral view of the nasopharynx should be taken. (Fig. 3 b.) In an axial film, tumors from the lateral walls of the nasopharynx show up especially well while on a lateral film, tumors from the roof and posterior wall are seen best. All these tumors are visible as soft shadows bulging into the air-filled lumen.

Lateral pictures are taken in a sitting position with a distance from focus to film of 2 m., kV 80, mA 150, time 0.3—0.4 sec. In order to increase the size of the air-filled cavity and thus improve the contrast of the pictures, the patient can force air up into the upper air passages while keeping his mouth and nostrils closed. The other pictures are taken on LYSHOLMS skull table according to the method described by him for examination of the skull.

10 of the 33 cases röntgen examined had no neurological symptoms and in none of these was there any destruction of the base of the skull. 8 cases presented symptoms from the 2nd and 3rd branches of the trigeminal nerve. Since these run part of their course on the inferior surface of the base of the skull, they can be invaded by the tumor without it having penetrated the cranial cavity. In 4 of these cases there were no changes in the base of the skull röntgenologically demonstrable. 4 cases showed areas of destruction. The remaining 15 had symptoms from the first branch of the trigeminal, the nerves to the muscles of the eye or the optic nerve, which could not be reached by a tumour of the nasopharynx unless it had broken through the base of the skull. In all these cases destruction could be shown in the base of the skull. These added to the previously mentioned 4 cases made altogether 19 cases with areas of destruction. There was a clinically demonstrable tumor of the nasopharynx in 26 cases. In 18 of these it could be shown on the röntgen picture. In 22 of the 26 cases the tumor had been found clinically before the röntgen examination which therefore was not especially concerned with examining the nasopharynx tumor itself. Otherwise it is quite possible that the tumor could have been röntgenologically demonstrated in more cases. The smallest tumors we have been able to demonstrate were clinically the size of a hazel nut. *In 4 cases röntgen examination demonstrated a nasopharynx tumor before it had been suspected clinically.*

The pathological report in the cases with destruction is as follows:

| | |
|---|---|
| Lymphoepithelioma | 6 cases |
| Undifferentiated cancer | 2 » |
| Basal cell cancer | 3 » |
| Squamous cell cancer | 1 » |
| Spindle cell sarcoma | 1 » |
| No biopsy obtained | 6 » |
| | 19 cases |

E. G. MAYER considers that he found a difference in the appearance of destruction due to carcinoma and that due to sarcoma. Such a distinction could not be found in this material — neither between the different types of cancer nor between them and the lymphoepitheliomas.

Some of the most typical cases are described below.

*Case 1.* (O. S. V. Bi. S. 371.) P. A. D. Lymphoepithelioma. For 3 months, an obstruction in the nose, chiefly on the left side, and blood-stained discharge from the left nostril. For one half year headache, usually in the forehead. Double vision for 2 months.

*Status on admission to the Radiumhemmet.* In the left half of the nasopharynx, a plum-sized tumor, covered by thin mucous membrane with tortuous blood vessels. The tumor seems to have grown out from the roof of the nasopharynx at the posterior edge of the septum. Ptosis of the upper lid of the left eye with paresis of all the muscles. Complete paralysis of the occulomotor nerve with paresis of the trochlearis and abducens. The other cranial nerves showed no abnormality. Sight was decreased in both eyes but this impairment had been present for several years. No more defective vision in the left eye than in the right.

*Röntgen examination* (Fig. 3 a, b. c, d). Large soft shadows in the nasopharynx, bulging in from the anterior part of the left lateral wall and the roof.

An area of destruction in the base of the skull involving the greater part of the middle cranial fossa. The pterygoid process on the left side is almost completely destroyed and the orbital fissure is definitely wider on the left than on the right. Its boundaries are thin and partially indistinct. The area of destruction extends posteriorly to the pyramid whose apex is destroyed. The left contour of the clivus is destroyed anteriorly. Otherwise no destruction in the clivus.

Röntgen examination has demonstrated a large nasopharynx tumor involving the left lateral wall and roof with extensive destruction in the middle cranial fossa and the posterior portion of the orbit on the left side.

*Case 2.* (K. A. H. Ct. S. 3288). P. A. D. Basal cell cancer. Obstruction in the nose for 3 years and blood-stained discharge for 1 year. On admission to the Radiumhemmet a large tumor filled the whole nasopharynx and the posterior part of both nasal passages. After treatment with röntgen and radium the tumor decreased to the size of a finger tip but did not disappear and $1^1/_2$ years after radiation the patient developed neurological symptoms in the form of headache and double vision. At the time of the röntgenological examination the tumor was clinically the size of a finger tip and situated on the posterior wall of the nasopharynx.

*Röntgen examination* $^{26}/_1$ 1931. (Fig. 4.) Destruction of the clivus and base of the skull on both sides. There remained only a small remnant of the clivus on the right side. The destruction also involved a large area behind the pyramids. The contours of the right jugular foramen were completely destroyed. No tumor of the nasopharynx was seen.

*Case 3.* (A. L. Ct. S. 3334.) No biopsy taken. The first symptom was headache on the right side. Finally after local symptoms developed, the diagnosis was made and the patient sent to the Radiumhemmet. The tumor grew out from the posterior wall of the nasopharynx and extended around the whole nasopharynx so that both Eustachian tube orifices were obliterated. Symptom free for $1^1/_2$ years after radiation. Then a recurrence developed in the left part of the nasopharynx. In January 1932 headache in the left part of the head and later paralysis of the eye muscles.

*Röntgen examination* $^{3}/_{1}$ 1933. (Fig. 5.) Tumor of soft tissues in the left part of the nasopharynx. Destruction involving the medial portion of the floor of the medial cranial fossa (the spinous foramen and the foramen ovale are included in the destruction). The anterior portion of the apex is also destroyed.

*Case 4.* (H. M. D. Ct. S. 3308.) No biopsy taken. Buzzing in the left ear for 1 year. Headache on the left side. On admission to the Radiumhemmet a large tumor growing out from the right side of the nasopharynx but also extending over on the left side. Following radiation the tumor in the nasopharynx disappeared, but during the whole period the patient had neurological symptoms suggestive of an invasion of the base of the skull. Besides ache on the left side of the head corresponding to the 1st and 2nd branches of the trigeminal, the patient developed paralysis of the eye muscles.

*Röntgen examination* $^{22}/_{7}$ 1931. (Fig. 6.) No tumor of the soft tissues visible in the nasopharynx. Destruction of the apex of the pyramid and the region of the foramen lacerum on the left side.

## In the following cases the clinical diagnosis was unclear until röntgen examination revealed the real nature of the disease process.

*Case 5.* (L. G. L. Bi. S. 359.) Pathological diagnosis: Lymphoepithelioma. Enlargement of the lymph nodes of the neck for 1 year. On admission to the Serafimer Hospital, bilateral enlargement of cervical lymph nodes and metastases in the mediastinum. Lymphogranulomatosis was suspected until the biopsy showed it to be lymphoepithelioma. No nerve symptoms. Because of the pathological diagnosis the primary tumor was suspected to be in the nasopharynx.

*Röntgen examination* $^{14}/_{2}$ 1933 (Fig. 7) showed a large tumor of soft tissues practically filling the whole nasopharynx; density of the right ethmoidal region and destruction of its septa. No destruction in the base of the skull.

*Case 6.* (H. B. Ct. S. 3383.) Patient had suffered 1 year from buzzing in the ears and trigeminal neuralgia and was sent to the Serafimer Hospital with this diagnosis.

*Röntgen examination* $^{16}/_{9}$ 1932 (Fig. 8) showed destruction in the middle cranial fossa on the right side and the appearance suggested that it might be due to a tumor of the nasopharynx. However, none could be demonstrated on the röntgen picture. Later a tumor was clinically demonstrated in the right portion of the nasopharynx.

*Case 7.* (E. D. Ct. i. 3961.) This patient had been treated for 2 years by different doctors under the diagnosis of tuberculous lymphoma. Finally he developed abducens paralysis on the left side. This complication was believed to be due to an intracranial tuberculoma.

*Röntgen examination* $^{28}/_{10}$ 1931 (Fig. 9) showed a tumor in the nasopharynx and destruction af the base of the skull around the foramen lacerum. After this, a tumor was clinically demonstrated in the roof and posterior wall of the nasopharynx.

*Case 8.* (J. C. Ct. S. 3297.) This patient had had right-sided headache for $^{1}/_{2}$ year and double vision for 1 month. The case was considered one of cerebral tumor and the patient was sent to the Serafimer Hospital.

*Röntgen examination* $^{3}/_{6}$ 1931 (Fig. 10) showed a large area of destruction of the base of the skull in the middle cranial fossa on the right side and a tumor in the right portion of the nasopharynx. Later a large tumor was clinically demonstrated in the upper right part of the nasopharynx.

Although destruction of the base of the skull of this type is usually produced by malignant tumors of the nasopharynx, similar changes can be brought about by intracranial tumors. In the material of the Serafimer Hospital there are cases of hypophyseal tumors which produced similar destruction of the base of the skull. In these cases, changes in the sella turcica make the differential diagnosis easy. One case of neuroma of the Gasserian ganglion had caused destruction of the apex of the pyramidal bone. This looked exactly the same on an axial film as a nasopharynx tumor but on a frontal picture the extent of the destruction decreased from above downwards. — One case of glioma in the temporal lobe had lead to destruction in the middle cranial fossa which was only observed on the axial view. In such a case no definite diagnosis can be made röntgenologically even in the absence of tumor shadows in the nasopharynx.

In cases where one can show destruction of the base of the skull and a tumor shadow in the nasopharynx and where there is no röntgenological evidence that the destructive process began in the cranial cavity, a diagnosis of nasopharynx tumor can be made with rather great confidence. Evidence of an intracranial origin of the destructive process should exclude the diagnosis of nasopharynx tumor. Only in relatively few cases are the röntgenological signs so indefinite that no certain diagnosis can be made (as in the case of glioma of the temporal lobe described above.)

## SUMMARY

During the last 3 years, 33 cases of malignant tumor of the nasopharynx have been röntgen examined at the Serafimer hospital. On the basis of this experience, the technique is reported which was found most suitable in demonstrating the soft tumor in the nasopharynx and the bone destruction in the base of the skull. After a short summary of the clinical and röntgenological findings in the series, some of the most typical cases are described in detail. Finally, the röntgenological differential diagnosis of malignant tumors of the nasopharynx is discussed.

## ZUSAMMENFASSUNG

In den letzten 3 Jahren wurden am Serafimerkrankenhause 33 Fälle von bösartigem Nasopharynxtumor röntgenuntersucht. Auf Grund der dabei gewonnenen Erfahrung berichtet Verf. über die Technik, die für die Demonstrierung des weichen Tumors im Nasopharynx und der Knochenzerstörungen an der Schädelbasis am geeignetsten befunden wurde. Nach einer kurzen Zusammenfassung der klinischen und röntgenologischen Befunde in den Serien werden einige von den typischsten Fällen im einzelnen beshrieben. Schliesslich erörtert Verf. die röntgenologische Differentialdiagnose maligner Nasopharynxtumoren.

Fig. 1.

Fig. 2 b.

Fig. 2 a.

Fig. 3 b. *Case 1.*



Fig. 3 d. Left orbita. *Case 1.*



Fig. 3 a. *Case 1.*



Fig. 3 c. Right orbita. *Case 1.*

Fig. 5. *Case 3.*



Fig. 7. *Case 5.*



Fig. 4. *Case 2.*



Fig. 6. *Case 4.*

Fig. 9. *Case 7.*

Fig. 8. *Case 6.*

Fig. 10. *Case 8.*

## RÉSUMÉ

Au cours des 3 dernières années, 33 cas de tumeurs malignes du rhinopharynx ont été soumises à l'examen radiologique à l'hôpital des Séraphins. Sur la base de ces examens, l'auteur communique la technique qui a paru le plus propre à la découverte des tumeurs molles du rhino-pharynx et des destructions osseuses à la base du crâne. Après un bref exposé des découvertes cliniques et radiologiques de ces séries, l'auteur donne une description détaillée des cas les plus typiques. Il discute enfin le diagnostic différentiel des tumeurs malignes du rhino-pharynx.


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Since this paper was completed an article by KARL-ERIK GROTH entitled, »The Röntgen Picture of the Epipharynx of Children under Normal Conditions and by Adenoid Vegetations» has appeared in Acta Radiologica 1933, XIV, Fasc 5, 463.

FROM THE ROENTGEN CLINIC OF THE FINSEN INSTITUTE, COPENHAGEN
(CHIEF: E. COLLIN, M. D.)

# ROENTGEN EXAMINATION OF LARYNGEAL AND HYPOPHARYNGEAL TUMORS[1]

by

*Börge Worning*

(Tabulæ V—IX)

The earliest communications concerning roentgen examination of the larynx were made by SCHEIER, first at the Congress of Natural Sciences at Frankfort, in 1896, and, later, in 1901. The film by which he studied the ossification of the laryngeal cartilages had been roentgenographed from dead bodies, and so were the ones used later, for the same purpose, by FRAENKEL, in 1908. The long exposure necessary made laryngeal roentgenography from the living subject very difficult, and communications based on that proceeding are therefore extremely rare. One of the few to be found in the literature is by BEHN (Kiel, 1901), and gives a very fine picture of a laryngeal tumor. The movements of the larynx during the processes of speaking and swallowing, on the other hand, have been studied under fluoroscopy by a number of authors, for instance by SCHEIER, GUTZMANN, FLATAU, PANCOST, MOELLER and FISCHER.

The first really comprehensive roentgenological study of the larynx is the one published in 1913, by THOST, as supplementary volume XXXI to the »Fortschritte a. d. Gebiete der Roentgenstrahlen». In this, the roentgenological picture of the larynx in health and disease is described in considerable detail. The first communication dealing with any considerable series of roentgenographed and roentgen-treated laryngeal tumors was published in 1927, by LIEBERMANN, of the Institute for Tumor Research in Moskva. It contains the description of 22 cases (with 25 illustrations), and as the result of his studies the author strongly emphasises the necessity for roentgen examination. The same is insisted upon by COUTARD, who, in September 1932, published his results of roentgen treatment in epithelioma of the larynx and hypopharynx during a period extending from 1920 to 1926, and — in collaboration with BACLESSE — the roentgen examination of those cases.

[1] Submitted for publication 29. XI. 1933.

COUTARD's arguments for the necessity of the roentgenological examination are as follows. *Before treatment:* as substitute for, or supplementary to laryngoscopy, and as an aid to the diagnosis of tumors situated in places where it is difficult for the laryngologist to observe them, as, for instance, in Morgagni's sinus or in the preepiglottic depressions; *during irradiation treatment:* as a means of closely following the changes in the tumor, and of observing the edemas which are a factor so largely to be considered in the conduct of the treatment; *after treatment:* as a means of detecting any destruction of the laryngeal cartilages. The film will disclose any such destructions, and at the same time the roentgenological picture will be a better basis than any clinical examination for diagnosis of a possible recurrence and for the differential diagnosis between the latter and a late necrosis.

The roentgenological picture of the healthy larynx was described, in 1928, by HICKEY. Tumors of the larynx and the thyreoid gland were the subject of a paper by PACK, in 1931; and in the same year, DILLON, GINSBURG and WULFSON wrote about the roentgen diagnosis of diseases of the larynx. Roentgen examination in laryngeal tuberculosis has been written about by several authors, for instance by ADLER and WODSILKA in 1928, WULFSON and GINSBURG in 1930, GILSON and PANOW in 1931.

In 1928, KELEMEN in cases of tuberculosis found disturbances of the laryngeal sensibility when the patient was made to swallow an ordinary barium porridge. The substance glided down along the anterior wall of the larynx and trachea, and in several instances he thus obtained good pictures of the mucosal lining. This proceeding was tried again in the following year by BELLI and CARNEVALE-RICCI, with the result that they ascertained such disturbances in 40 per cent. of their cases. In 1931, the method was further elaborated by TEBRUEGGE and BERBERICH, who repeated the roentgen examinations 30 minutes, 1 hour and 90 minutes after ingestion, and not only in all the cases found remnants of the contrast meal in the epiglottic valleculæ, the laryngeal aperture and the esophagus, but were able to show that the condition described was nothing specific for tuberculosis, but might be observed also in cases of laryngeal carcinoma, laryngeal edema, pharyngolaryngitis and other affections of the larynx. GIL and CHUCURRA, finally, have in 1932 published a preliminary communication describing a method of looking for ulcerations in the larynx. They found that when the mucous lining of the latter was painted with a contrast fluid after it had first been treated with cocaine, the contrast medium would adhere better than it would to the normal lining.

At the Finsen Institute and Radium Centre we have since the fall of 1931 roentgen-examined 50 cases of laryngeal and hypopharyngeal

tumors, and have found that the results agreed in almost every particular with those obtained by laryngoscopy. It is our experience that neither of the methods by itself gives sufficient information, but that the two supplement each other very fully. The differential diagnosis it is very often difficult to establish by roentgen examination alone. As a rule the latter cannot, for that purpose, compare with laryngoscopy, if necessary supplemented by an excision for bioscopy; but the scrutiny and interpretation of the roentgenograms, with the laryngoscopy for a basis, will give a variety of information of the greatest importance when it comes to decide on the treatment to be adopted, — information which can be obtained only by roentgen examination.

Briefly stated, this information, according to our experience, concerns, 1) the limit of the tumor's extent in downward direction; 2) the extent of its growth into the region back of the larynx, and its recurrences there; 3) the destructions of the laryngeal cartilages.

### Ossification of the Laryngeal Cartilages

An important factor as regards these examinations is the ossification of the laryngeal cartilages, because these in themselves are not visible in the roentgenogram, but only become so when either ossification or calcification sets in. The largest of them, such as the thyreoid, the cricoid and the arytenoid cartilages — the latter with exception of the vocal process — are composed of the hyaline variety of cartilage, which physiologically has a tendency toward ossific change; while the vocal process, like the epiglottis and the cartilages of Santorini and Wrisberg, are formed of fibro-cartilage, which never ossifies. The manner in which the ossific change occurs, and its normal course, have been described by CHIEWITZ (1882), SCHEIER (1901) and FRAENKEL (1908).

CHIEWITZ determined the extent of the ossification by pricking the cartilage with the point of a knife; SCHEIER and FRAENKEL, as we have seen, used roentgenography for the purpose. The ossification is largely endochondral, only to a slight extent ectochondral, and takes place in the usual manner, with preliminary calcification, ingrowth of blood vessels and breakdown of the calcified cartilage, followed by a building up of osteous tissue and deposition of lime salts in the latter. The process of calcification starts in the thyreoid cartilage, usually at about the twentieth year of age, with a centre of ossification in the inferior cornu, whence it spreads to the inferior and posterior margins of the lamina and to the superior cornu. In the latter there sometimes develops an independent centre, which then in the course of time joins with the inferior one.

The ensuing course of the ossification is different in the two sexes. In the female, the posterior half of the lamina becomes ossified. The an-

terior limit of the process can either be vertical or else extending in a series of steps forward along the inferior margin. Sometimes a second osseous centre is formed medially, and in about 50 per cent. of cases this extends backward in such a manner that the entire inferior margin will be ossified. In the male a projection forms, which arises diagonally, in an anterior direction, from the middle of the inferior margin. Its an-

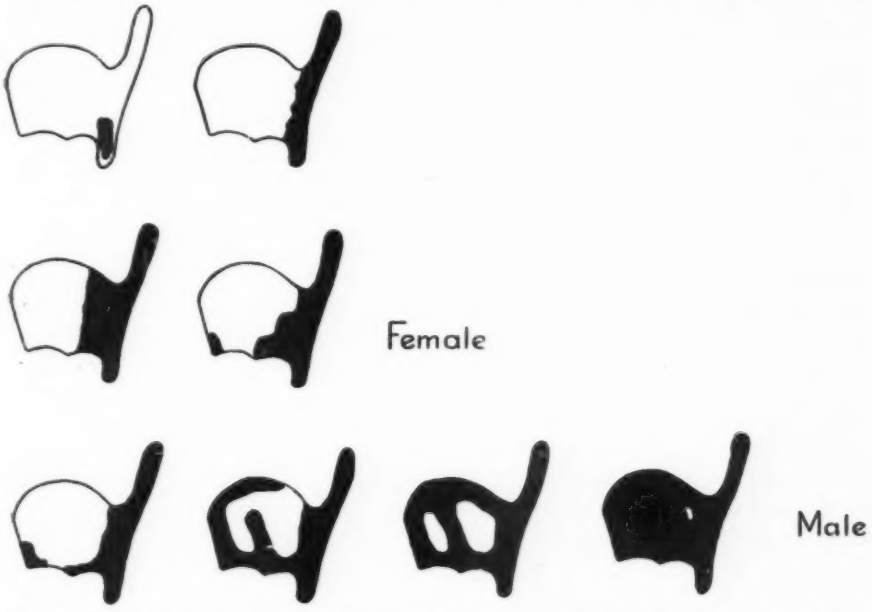


Fig. I. Schematic representation of the ossification of the thyreoid cartilage, resp. in male and female subjects.

terior edge becomes ossified from an independent centre, its upper edge from behind; the result being the formation of two oval spaces, which themselves end by becoming filled out with the osseous tissue, so that the thyreoid cartilage in the male is sometimes found ossified all through. The sexual difference here described is not absolute, however. As FRAENKEL and LIEBERMANN have shown, the male-type ossification is sometimes found also in females.

The ossification of the cricoid cartilage takes place a little later. It begins in the lamina, whence it gradually extends all the way around.

The arytenoid cartilage is the last to become ossified. The age at which the process begins, and the speed of its development, vary considerably. There can be a difference of forty or fifty years between

individuals in whom the same degree of ossific change is found. It is therefore impossible to judge a patient's age from the extent of the ossification. As a rule, however, the process in the thyreoid cartilage will have terminated by the fiftieth or sixtieth year.

The ossification always develop symmetrically. The ossified cartilage is seen in the roentgenogram as a faint spongy bone deficient in calcareous substance and surrounded by a very narrow, strongly marked line representing the thin layer of compact substance. The preliminary calcification shows in the roentgenogram as strongly marked irregular calcareous shadows forming a border anteriorly from the already ossified portion, corresponding to the areas physiologically subject to the further spread of the ossific process.

Various diseases of the larynx, such as tuberculosis and syphilis, are often accompanied by an extensive calcification of the laryngeal cartilages, which is undoubtedly of a different character, however, from the physiological calcifications. In the first place it is in tuberculosis more extensive, more diffuse, and — according to THOST — is not followed by the physiological ossification; and in syphilis the calcareous elements show, besides, a characteristic formation distinctly of their own, being shaped as deeply indented, finely branched stars. In the second place, the calcification in these diseases does not occur in the usual sequence. Thus, in tuberculosis the process is observed only in the arytenoid cartilage, while in the case of physiological calcification it begins later there than in the cricoid cartilage. Finally, in the cases where a tumor grows into an ossified laryngeal cartilage one finds processes of calcification going on concurrently with the destructions.

## Technic of the Roentgenography

The literature usually prescribes narrow-framed casettes with two intensifying screens, the patient to be placed either standing, recumbent or sitting, with the casette above the shoulder, close against the neck. OEHLECKER has constructed a casette specially adapted for this purpose, with the lower part of the frame hollowed out to fit the rounding of the shoulder. The focus-to-film distance varies from 50 to 75 centimeters, the time of exposure from two tenths of a second to 1 second, with 20 to 40 milliampères and 60 to 80 kilovolts. As a rule, only side views are taken, because in the ventrodorsal projection the spinal column covers the field almost entirely. In some few cases diagonal projection may be used.

A method for roentgenographing the larynx in ventrodorsal projection without getting the spinal column into the picture was devised by RETHI, in 1912, and presented later by him and SZEBENY at the Con-

gress of Otology in Copenhagen, in 1929. It consists in introducing the film, which has previously been cut to a pattern and wrapped in a light- and moisture-proof envelope, into the hypopharynx, after the latter has been thoroughly painted three times with a 10 to 20 per cent. solution of cocaine, whereupon the exposure is made with ventrodorsal direction of the rays. Upwards, the roentgenographic picture will then take in the hyoid bone and sometimes the epiglottis, toward the sides the posterior margins of the thyreoid cartilage, medially the ventricular and vocal folds and Morgagni's sinus.

At the Finsen Institute, we have for the lateral projection preferred to place the casette in front of the shoulder, with the lower edge of the frame four or five centimeters below the rounding of the latter. At the same time we have increased the focus-to-film distance to 175 centimeters, in order to avoid pictorial errors of proportion and for the sake of added sharpness. Besides, the greater distance has the advantage of diminishing the secondary radiation on the film.

The patient is placed sideways on an ordinary chair for pulmonary examination, with his head supported by a couple of soft pillows, the shoulders well back, the neck stretched, the head bent slightly backward. Care must be taken that the head is held at a right angle to the shoulders, and the radiation directed at a right angle to the neck, so that the two halves of the larynx cover each other as completely as possible. By so doing, one will be able to get the trachea, as far down as to the superior aperture, and as a rule the first thoracic vertebra, into the picture. Of each case two lateral pictures are taken, one from each side, and in addition a ventrodorsal and a lateral view during the process of swallowing a mouthful of barium porridge. The time of exposure varies from three fourths of a second to 1 second, with 40 milliampères and 60 kilovolts.

## The Roentgenogram of the Normal Larynx

From the viewpoint of skiagraphic effect, the elements composing the larynx may be divided as follows: a) the osseous parts, b) the pharyngeal and laryngeal cavities, c) the surrounding soft tissues. In the upper part of the accompanying diagram are seen the mandibular arch and the inferior portion of the ascending ramus. Posteriorly are the bodies of the cervical vertebræ and of the first thoracic vertebra.

ad a). — Anteriorly from the space between the third and fourth cervical vertebræ lies the hyoid bone, the apex of its cornu extending to the posterior wall of the pharynx. The laryngeal cartilage is invisible unless ossified or calcified. The thyreoid cartilage lies in front of the fifth cervical vertebra, its cornu extending upward to the middle of the latter.

The arytenoid cartilage also lies in front of the fifth cervical vertebra, but covered by the posterior part of the thyreoid cartilage. The cricoid cartilage, likewise partly blending with the posterior, inferior part of the thyreoid cartilage, lies in front of the sixth cervical vertebra. Corresponding to the trachea one sometimes sees ossified tracheal bars.

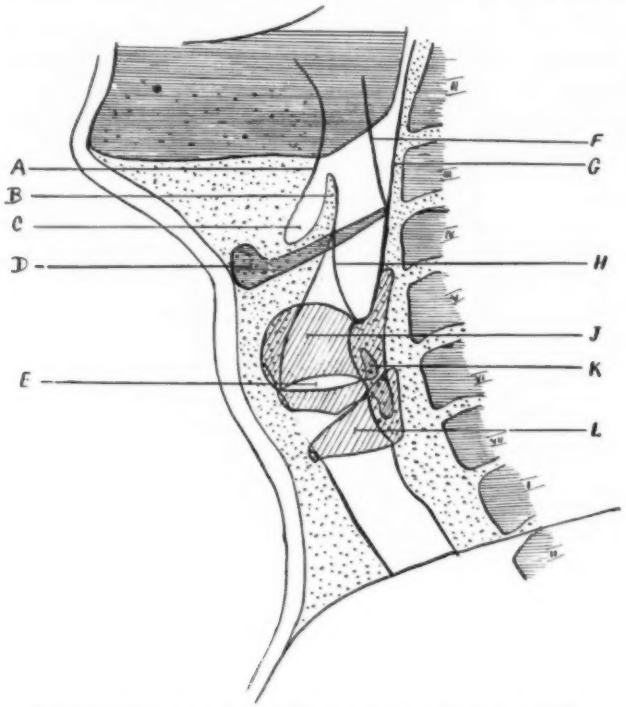


Fig. II. Schematic Representation of the normal Roentgenogram.

*A*. Base of the tongue. — *B*. Epiglottis. — *C*. Epiglottic vallecula. — *D*. Hyoid bone. — *E*. Morgagni's sinus. — *F*. Pharyngo-palatine arch. — *G*. Posterior wall of the parynx. — *H*. Aryepiglottic fold. — *I*. Thyreoid cartilage. — *K*. Arytenoid cartilage. — *L*. Cricoid cartilage.

ad b). — The pharyngeal and laryngeal cavities, which, being filled with air, are the parts most easily penetrated by the rays, are bordered anteriorly by the base of the tongue, the epiglottic vallecula, the upper apex of the epiglottis, the laryngeal surface of the same, and by the larynx and the anterior wall of the trachea. Their boundaries posteriorly are the posterior wall of the pharynx, the arytenoid region and the posterior walls of the larynx and trachea. The tissue shadows within the air-filled areas are, farthest upward, the pharyngopalatine arch, and farther

down the aryepiglottic fold, which forms the boundary of the superior aperture of the larynx. The larynx, owing to its lesser width from side to side, is not so easily penetrated by the rays as the pharynx. Morgagni's sinus is seen as a lenticular clearing, its upper contour more convex than the inferior one. It is bordered upwards and downwards by denser areas representing respectively the ventricular and vocal folds.

ad c). — The soft-tissue shadows surrounding the lumen of the pharynx and larynx represent anteriorly the root of the tongue, the preepiglottic fatty tissue and the soft tissues on the anterior side of the neck. Posteriorly, the back wall of the pharynx, together with the ligaments on the anterior aspect of the vertebral column along the latter form only a soft-tissue shadow 2 to 4 millimeters broad; but in the arytenoid region this shadow broadens considerably, so that the distance between the laryngeal lumen and the vertebral column is increased to about 18 centimeters. In the anterior half of this shadow lies the posterior part of the thyreoid and cricoid cartilages, and the arytenoid cartilage. The opening of the esophagus is found on a level with the inferior margin of the cricoid cartilage.

## The Roentgenographic Picture of Laryngeal and Hypopharyngeal Tumors

Tumors in the larynx and hypopharynx manifest themselves roentgenographically chiefly in three ways, namely, 1) by projecting into the lumen of those organs, 2) by dislocating the larynx, 3) by destroying the laryngeal cartilages.

ad 1. — If a tumor projects itself into the lumen of the larynx or hypopharynx, a corresponding volume of air will be displaced by tumor tissue; and as the latter constitutes a mass distinctly circumscribed from the remaining air, it will in the roentgenogram be visualised as a sharply contoured soft-tissue shadow. On the other hand, if the tumor is situated in the surrounding soft tissues, and especially if its growth is infiltrating, there will be no roentgenographic contrast, because the absorption and spreading of the roentgen rays is the same in the two tissues. This, however, will be the case only up to a certain limit; namely until the tumor becomes so large that it causes a demonstrable loss of radiation as compared with the loss in the tissue surrounding it. When this stage has been reached, the result in the roentgenogram will be the presence of a denser area, which, if the tumor is sufficiently circumscribed from its surroundings, will stand out as a definable soft-tissue shadow.

ad 2). — If the tumor lies outside the larynx it will, when it has reached a certain size, dislocate the latter; and as the various elements composing the larynx are firmly connected with each other this dislo-

cation will always be *in toto*. In the side view only a dislocation in anterior direction will be visible, but this is also the most frequent form, because the vertebral column prevents dislocation backwards, and because piriform tumors often have a tendency to extend their growth in behind the larynx. Dislocation in a lateral direction will as a rule be visible in the ventrodorsal projection, but in such cases an ordinary clinical examination will generally give better information than the roentgenogram.

ad 3). — If a tumor extends its growth into an ossified laryngeal cartilage the result will be, on the one hand disintegration, on the other hand neoformation, of bony tissue. The roentgenological picture of an ossified laryngeal cartilage infiltrated by a tumor will therefore represent a mixture of destructive processes expressing themselves in numerous irregular rarefactions with ragged, uneven contours, and neoplastic processes manifesting themselves by new formation of bone and small calcifications. If the destruction is extensive the diagnosis will be comparatively easy, but in case of only minor destructions it can often be difficult, especially if the physiological ossification is not yet terminated; because both the contours and the structure in the zones of ossification are always more or less irregular.

The following cases are all of microscopically verified tumors, partly from the Radium Centre, partly from the Otolaryngologic Department of the Finsen Institute. I wish here to express my sincere thanks to the senior physicians, Dr. STRANDBERG and Dr. JUUL, for permission to use the material, for assistance with the often difficult interpretation of the films, and for the interest which they have kindly shown in my work all through.

*Case I.* Male, aged 51 years. Has suffered for 2 months from difficult deglutition and gradually increasing hoarseness.

*The laryngoscopy* shows a tumor, the size of a pigeon's egg, which covers the laryngeal opening. On direct inspection it is seen that it must arise from the epiglottis, because the base of the tongue as well as the sides of the pharynx are free, besides which the tongue is displaced in relation to the tumor. *Medical diagnosis:* solid cornescent carcinoma. *The roentgen examination* (Fig. 2), like the laryngoscopy, shows a tumor the size of a pigeon's egg, filling the whole of the pharyngeal lumen between the root of the tongue and the posterior wall of the pharynx, leaving only a narrow interstice next to the former. It extends upwards to the angle of the mandible; its lower pole, which could not be determined laryngoscopically, is seen on a level with the hyoid bone.

The case was treated by the method indicated by COUTARD. Six months later, *laryngoscopy* revealed no trace of tumor; only some thickening of the epiglottis and ligaments. *Roentgen examination* (Fig. 3) showed the epiglottis somewhat blunted and thickened; but otherwise nothing abnormal.

*Case II.* Male, aged 70 years. Has suffered for 2 months from hoarseness and pains in the throat.

Fig. 2.

Fig. 4.

Fig. 1.

Fig. 3.

NORMAL.

*Tabula VI*

Fig. 7.

Fig. 10.

Fig. 6.

Fig. 9.

Fig. 5.

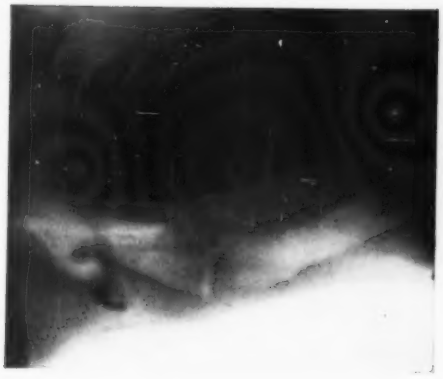

Fig. 8.

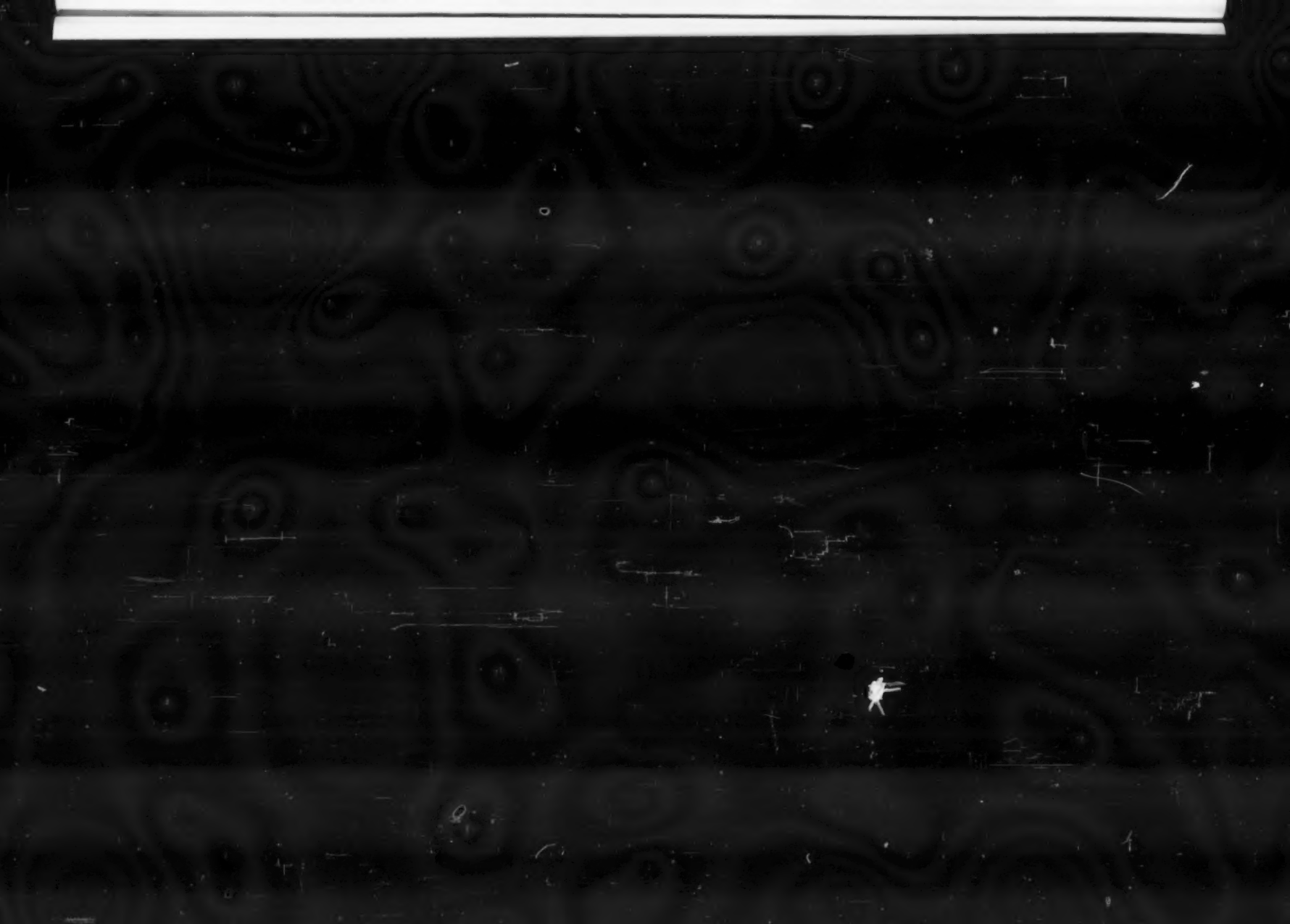

Fig. 13.

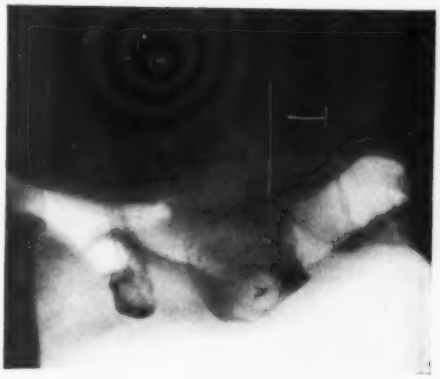

Fig. 16.

Fig. 12.

Fig. 15.

Fig. 11.

Fig. 14.

Fig. 19.

Fig. 22.

Fig. 18.

Fig. 21.

Fig. 17.

Fig. 20.

*Tabula IX*

Fig. 25.

Fig. 28.

Fig. 24.

Fig. 27.

Fig. 23.

Fig. 26.

*Laryngoscopy* shows in the left side of the hypopharynx a tumor which involves the glossoepiglottic fold, the lateral surface of the epiglottis and the aryepiglottic fold. It probably extends downward into the piriform sinus, but whether this is actually the case cannot be positively ascertained. *Roentgen examination* (Fig. 1) shows the aryepiglottic fold thickened, with a convex rounding posteriorly, and a greater opacity of the pharyngeal lumen back of the epiglottis. A little below the tip of the epiglottis is seen the upper line of a fold, probably the thickened glossoepiglottic. There is no destruction of the laryngeal cartilages; here the two oval spaces, not yet ossified, are distinctly seen. Finally, the roentgen examination shows that there is no ingrowth of the tumor back of the larynx, as the interval there has not become enlarged.

*Case III.* Male, aged 54 years. About 3 months ago he noticed a swelling on the left side of his neck; later, he found difficulty in swallowing. When he was examined a distinct stridor was noticed.

*Laryngoscopy* shows in the left side a large tumor involving part of the hypopharynx, the epiglottis and the left arytenoid region. In the epiglottis is seen an ulceration. A portion of the tumor, the size of a walnut, projects over the larynx. Corresponding to this condition, the *roentgen examination* (Fig. 4) shows a large tumor occupying the whole space beetwen the epiglottis and the posterior wall of the pharynx. It extends from the tip of the epiglottis, which is pressed forward, down to the upper margin of the thyreoid cartilage, and protrudes largely into the aperture of the larynx. The roentgenogram shows in this place only a narrow air passage anteriorly from the tumor; but it is of course impossible to see how much of such open space there may be left on the sides. There is also a considerable dislocation forward of the whole larynx. This results from an increase of the soft tissues in the laryngovertebral space all the way down to the inferior margin of the seventh cervical vertebra, and shows that the tumor extends in behind the larynx and trachea.

The patient was given roentgen treatment in the manner indicated by COUTARD. Four months later, *laryngoscopy* showed the left side of the arytenoid region and the epiglottis itself somewhat thickened, and the mobility in the left side of the larynx much diminished, but no positive trace of tumor tissue. It was impossible to get a view into the piriform sinus. *Roentgen examination* (Fig. 5) still showed a soft-tissue shadow between the epiglottis and the posterior wall of the pharynx. It blurs the outline of the aryepiglottic fold, but is considerably smaller than before, and the epiglottis has resumed its normal position. Finally, the width of the laryngovertebral space is now nearly normal.

Two months later, the patient presented himself again for examination, because he had for a couple of weeks felt a return of the old difficulty in swallowing. On the left side of his neck, below the ramus of the mandible, there was now a firm, immovable intumescence the size of a hen's egg. *Laryngoscopy* showed some swelling in the region of the left arytenoid cartilage and left side of the epiglottis, and the left arytenoid region pressed inward toward the medial line. There was no sign of ulceration anywhere, and probably no recurrence, as the swollen parts were the same as when he was last examined. The *roentgen examination* (Fig. 6) showed the lumen of the pharynx more clearly, so that the aryepiglottic fold was now visible; but otherwise the condition within the lumen of the larynx was, on the whole, unchanged. On the other hand, the laryngovertebral space had again become broader, — an almost sure indication of recurrence there, eventually borne out by the fact that the patient died, six months later, under increasing difficulties of respiration.

*Case IV.* Female, aged 48 years. Has for 4 months suffered from pains when swallowing.

*Laryngoscopy* shows the presence, in the left piriform sinus, of a large papillomatous tumor, which bleeds when touched. The posterior wall of the larynx somewhat thickened. Medical diagnosis: solid cornescent carcinoma. *Roentgen examination* (Fig. 7) shows nothing abnormal in the lumen; nor was anything such to be expected when the tumor did not project into the latter, even though it completely filled the piriform sinus. On the other hand, it is seen that its growth extends downward, in behind the larynx and trachea, all the way past the first thoracic vertebra, causing both those parts of the tube to become dislocated forward, and compressing the trachea.

The patient was treated with roentgen in the manner prescribed by COUTARD. Two months later, *laryngoscopy* revealed no trace of tumor, and *roentgen examination* (Fig. 8) showed no positive increase in the width of the laryngovertebral space. Subsequent examination has shown no signs of recurrence.

*Case V.* Female, aged 74 years. Has been feeling tired and unwell for a year past, but with no local symptoms except a constant secretion of mucus in her throat.

The posterior wall of her pharynx is the seat of an oblong, projecting tumor, fully 3 centimeters long and between 1 and 1.5 centimeters broad, extending from the soft palate down to the epiglottis and reaching both the lateral walls. *Laryngoscopy* shows that it projects out over the arytenoid region, obstructing the view of the latter. The rest of the larynx is free. Medical diagnosis: flat-cell carcinoma. The *roentgen examination* (Fig. 9) shows a soft-tissue shadow, of the form of a cushion, about 5 centimeters long and 1.5 centimeters high, issuing from the posterior wall of the pharynx and extending from the soft palate down to a level with the arytenoid region. The hyoid bone is dislocated forward. The larynx shows nothing abnormal.

The patient was roentgen-treated *ad modum* COUTARD. Six months after the treatment the roentgenogram (Fig. 10) showed nothing abnormal.

As a rule, the roentgen examination of tumors in the pharynx does not yield much information. In this case, however, where the tumor is projected tangentially, a very good picture was obtained, in contrast to the following case, where the growth was situated in the side wall.

*Case VI.* Male, aged 45 years. Has had an uncomfortable feeling in his throat. Objective examination shows that the tongue is held back posteriorly, and cannot be extended quite straight forward. The left tonsil and the arches of the palate on that side, all the way up to the uvula, are transformed into a pleated tumor. The tongue is felt to be infiltrated right in to the median line. In the left submaxilla there is a gland the size of a large almond, and anteriorly from that another, as large as a date.

*Laryngoscopy* shows that the tumor extends along the lateral cords halfways down into the hypopharynx, but probably not into the valleculæ. Medical diagnosis: lympho-epithelioma. The *roentgen examination* (Fig. 11) shows only some faint, irregular, lumpy soft-tissue shadows, occupying the whole of the pharyngeal cavity nearly as far down as to the hyoid bone. The epiglottis seems to be pressed slightly backwards. Otherwise the larynx presents nothing abnormal.

On the whole, the roentgenological findings agree very well with the results of the clinical examination, but conclusions with regard to the pharyngeal cavity are difficult to form, because its width is extremely variable. The irregularity of the contour of the root of the tongue must not be interpreted as anything pathological.

*Case VII.* Male, aged 65 years. Has for 2 months been suffering from a steadily increasing tumescence on the right side of his neck, corresponding to the lower part of the sternocleidomastoid muscle.

At the point indicated there is found a firm, knobby, immovable swelling as large as a duck's egg, extending along the sternocleido from the mastoid process to 2 or 3 centimeters above the clavicle, and reaching anteriorly to the angle of the mandible, posteriorly to the middle of the lateral aspect of the neck. The trachea and larynx are displaced slightly toward the left. On inspection of the fauces, the right tonsil is seen slightly displaced in the direction of the median line; but it is quite soft, and there is no sign of any tumor. *Laryngoscopy* shows nothing abnormal. Medical diagnosis: solid carcinoma.

In this case we have thus to do with an extralaryngeal tumor, which projects only slightly into the lumen of the pharynx. It might consequently be expected that nothing would be found in the roentgenograms. Nevertheless, the *roentgen examination* (fig. 12) shows the anterior outline of a large soft-tissue shadow, extending from the angle of the mandible down behind the dorsal portion of the thyreoid cartilage. The posterior wall of the pharynx is not enlarged; consequently there is no ingrowth there; but the hyoid bone is displaced somewhat in anterior direction, and the picture is thus in a way the same as would result from the presence of a large, projecting tumor in the side wall of the pharynx. In this case, however, there is an entirely corresponding, solid tumor, the size of a duck's egg, extending from the angle of the mandible downward, and undoubtedly sufficient to produce a contrast effect in spite of the fact that it is situated entirely in the soft tissues on the side of the neck. It is therefore the most reasonable to suppose that it is the anterior outline of this tumor which we see projected into the lumen of the pharynx. This also agrees with the roentgenogram taken in ventrodorsal projection (Fig. 13), in which there is no shadow of any projecting tumor in the latter.

*Case VIII.* Male, aged 60 years. He states that he has for 15 years had a hard swelling, the size of a pea, in the region back of the mandible on the right side. During the last five years it has slowly increased in size, but in the last three months its growth has been more rapid, and at the same time he has begun to suffer from hoarseness, and now recently from difficult respiration. Examination shows in the right submaxillary region a triangular, firm, slightly displaceable tumor, $4 \times 3$ centimeters large.

*Laryngoscopy* shows in the right vallecula an ulcerated tumor about the size of a chestnut, which extends along the edge of the epiglottis and disappears in the piriform sinus. There is no sign of ingrowth into the larynx. In the places where the tumor is not ulcerated, it is slightly uneven. The adjoining part of the side wall of the hypopharynx is red and swollen. There is also redness and swelling of a chronic, edematous character throughout the whole right half of the larynx. The right side of the latter is rigid, the left side freely movable. Medical diagnosis: solid carcinoma. The *roentgen examination* (Fig. 14), supporting the laryngoscopical observation, shows a large tumor shadow in continuation of the epiglottis, only the tip of which seems to be free. Posteriorly, the shadow extends almost to the dorsal wall of the pharynx. Laryngoscopically it was observed that the tumor extended down into the piriform sinus. In the roentgenogram it is not possible to see how much tumor tissue there exists in the latter, but that the growth does not extend in behind the larynx can be almost positively concluded from the fact that the width of the laryngovertebral space has not become enlarged. On the other hand, a broad, rather heavy shadow in the lumen of the pharynx would seem to indicate that the tumor has infiltrated the side wall of the latter. The roentgenogram taken in ventrodorsal projection (Fig. 15) shows that the tumor is situated in the right side.

The patient was roentgen-treated in the manner prescribed by COUTARD, with the result that during the following days the tumor became considerably reduced in size. On laryngoscopical examination two weeks later it had receded so much that the roentgenological observation as to its engaging the side wall of the pharynx could be seen to have been correct.

Six weeks later, *laryngoscopy* showed that there still remained some slight infiltration of the right wall of the hypopharynx, and that the right side of the epiglottis and the aryepiglottic fold, as well as both arytenoid regions, were the seat of a slight edema. The roentgen examination (Fig. 16) showed perfectly normal conditions.

*Case IX.* Male, aged 58 years, with a carcinoma occupying the right side of the epiglottis.

The *roentgenogram* (Fig. 17) shows a tumor shadow corresponding to the aryepiglottic fold. After the patient has been made to swallow a mouthful of barium porridge it is seen (Fig. 18) that this has glided down along the anterior wall of the larynx and trachea, — thus indicating a disturbance of the laryngeal sensibility.

The patient was given roentgen treatment *ad modum* COUTARD, and on examination 6 months later the tumor was found to have disappeared completely. At the same time, the passage of a barium meal was perfectly natural, showing that there was no longer any disturbed laryngeal sensibility.

*Case X.* Male, aged 71 years. Has for 6 months been suffering from difficult deglutition and hoarseness.

*Laryngoscopy* shows that the posterior wall of the larynx is the seat of a large tumor involving both arytenoid regions and extending on both sides into the piriform sinus. Between the side walls of the hypopharynx and the tumor only narrow intervals can be seen. The epiglottis is not engaged. Medical diagnosis: solid cornescent carcinoma.

The patient was treated with roentgen in the manner indicated by COUTARD. On laryngoscopical examination 10 weeks later there was no longer any trace of tumor tissue to be found.

The *roentgenograms* (Fig. 19), completely agreeing with the laryngoscopical findings, show a large tumor shadow corresponding to the arytenoid region. The tumor projects into the larynx and extends downward back of the latter, in such a manner that the whole of the larynx, together with the epiglottis and the hyoid bone have become displaced in a forward direction, as distinctly seen by comparing the first roentgenogram with the one (Fig. 20) taken after the treatment. Both roentgenograms show destructions in the thyreoid cartilage. The contours of the superior cornu are irregular, and its structure, compared with the inferior portion, spotted with numerous small rarefactions and calcifications.

*Case XI.* Female, aged 62 years. Has for 6 months been suffering from pains in her throat and difficulty in swallowing.

The *laryngoscopy* shows a flat, ulcerated tumor, fully 1 centimeter in diameter, situated in the posterior wall of the hypopharynx, a couple of centimeters above the opening of the esophagus. It disappears down behind the larynx; on the right side a fold of it extends out over the arytenoid cartilage, but the larynx itself appears to be intact. *Esophagoscopy* shows, 20 centimeters from the dental line, an ulcerated, constricting tumor, which the esophagoscope cannot pass. Medical diagnosis: solid carcinoma. The *roentgenogram* (Fig. 21) shows a distinct increase in the breadth of the posterior wall of the pharynx and the laryngovertebral space, whereby the arytenoid region has been blotted out, while the larynx is dislocated forward and the lumen of the pharynx made

narrower. After ingestion of contrast meal the inferior margin of the tumor can be seen on a level with the superior margin of the seventh cervical vertebra (Fig. 22).

Two months after the last roentgen treatment *laryngoscopy* shows nothing abnormal. In the *roentgenogram* (Fig. 23) the laryngovertebral space is found of normal width, and there is no longer any obstruction to the filling of the esophagus (Fig. 24). In both pictures there is still, however, a noticeably abnormal thickness of the posterior wall of the pharynx, indicative of remaining tumor tissue there.

Six months later recurrence set in, and the patient died.

*Case XII.* Female, aged 52 years. Has for 3 months been suffering from cough and expectoration.

*Laryngoscopy* shows a tumor situated in the posterior wall of the hypopharynx, closely enfolding the whole posterior side of the larynx. It does not engage the latter, but completely fills the right piriform sinus, and extends nearly to the left one. Medical diagnosis: solid carcinoma. The *roentgen examination* (Fig. 25) shows a tumor behind the larynx, which has become dislocated forward. Upwards, the growth continues in the posterior wall of the pharynx as far as to the apex of the superior cornu; its inferior outline is seen on a level with the first thoracic vertebra. (The oval shadow, the size of a hazelnut, in front of the third cervical vertebra, is due to a calcified lymph node in the side of the neck). After the ingestion of a contrast meal it is distinctly seen (Fig. 26) how the tumor extends upwards in the posterior wall of the pharynx, above the arytenoid region; and also that the esophagus is infiltrated as far as to the level of the first thoracic vertebra.

Two months after the roentgen treatment, laryngoscopical examination no longer reveals any sign of tumor; nor does a *roentgen examination* (Fig. 27) show anything positively abnormal.

Some time later the patient began to suffer from some trouble of deglutition, wherefore an examination was made, which disclosed the existence, about 1 centimeter below the esophageal opening, of a strongly cicatricial area, which could not be passed by the esophagoscope. The laryngoscopy showed nothing particularly abnormal, and it was only by means of the *roentgenogram* (Fig. 28) that there was discovered, on the level of the first thoracic vertebra, a recurrence, which showed itself in a broadening of the tracheovertebral space and a slight compression of the trachea. The patient died four months later, and on necroscopy tumor tissue was found, extending from 4 or 5 centimeters below the esophageal opening down to the bifurcation.

## SUMMARY

At the Finsen Institute and Radium Centre in Copenhagen, all cases of laryngeal and hypopharyngeal tumor have for the last two years been systematically examined by roentgen. On the basis of the experience thus acquired, the author now communicates the results obtained by that method. The roentgenological examination is made as supplement to the laryngoscopy, and the roentgenograms interpreted on the basis of the latter. The examination serves to throw light on conditions which, as a rule, cannot be ascertained in any other way; namely: 1) the inferior limit of the growth; 2) its extension in behind the larynx; 3) destructions of the laryngeal cartilage; 4) early diagnosis of the recurrences.

The roentgen examination of laryngeal and hypopharyngeal tumors must therefore be considered as a useful, often necessary, measure in dealing with these affections.

## ZUSAMMENFASSUNG

Auf Grundlage systematischer Untersuchung von Tumoren des Larynx und Hypopharynx sämtlicher Patienten des Finseninstitutes und der Radiumstation in Kopenhagen im Laufe der letzen 2 Jahren, werden die Ergebnisse dieser Untersuchungsmethode mitgeteilt.

Die Röntgenuntersuchung wird zur Ergänzung der Laryngoskopie angewandt und auf dieser Grundlage die Deutung der Röntgenbilder vorgenommen.

Die Untersuchung gibt Aufschlüsse über Verhältnisse, die in der Regel nicht auf andere Weise klargelegt werden können, nämlich:

1) Die untere Begrenzung des Tumors.
2) Die Ausbreitung des Tumors hinter Larynx.
3) Die Zerstörungen des Kehlkopfknorpels.
4) Die Frühdiagnose der Rezidive.

Die Röntgenuntersuchung der Larynx- und Hypopharynxtumoren muss deshalb als ein nützliches, häufig notwendiges Glied der Behandlung dieser Leiden angesehen werden.

## RÉSUMÉ

Sur la base d'un examen radiologique systématique de tous les malades atteints de tumeurs du larynx et de l'hypopharynx à l'Institut Finsen et à la Station de radium de Copenhague, dans l'espace de 2 ans, l'auteur rend compte des résultats de cette méthode d'examen.

L'examen radiologique est utilisé comme complément de la laryngoscopie et l'interprétation des images radiologiques est faite sur cette base.

Cet examen permet la constatation de circonstances qui échappent en règle aux autres méthodes, savoir:

1) La limite inférieure de la tumeur;
2) L'extension de la tumeur en arrière du larynx;
3) La destruction des cartilages laryngés;
4) Un diagnostic précoce des récidives.

L'examen radiologique des tumeurs du larynx et de l'hypopharynx doit donc être considéré comme un temps utile et souvent nécessaire dans le traitement de ces affections.

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(CHIRURG. ABTEILUNG DES KOMMUNE HOSPITALS IN AALBORG. CHEF: HARALD MØLLER)

# SYMMETRISCHE BRACHYDACTYLIE UND HYPOPHALANGIE IN HAND UND FUSS[1]

von

*Ole Bouet*

(Tabula X)

Der Patient ist ein 56jähriger Mann, der wegen eines Leidens der Gallenwege im Spital aufgenommen wurde. Er hat eine angeborene Missbildung der Hände und der Füsse.

Die Hände sind kurz, breit, beinahe »fäustlingsartig», beide Hände sind nahezu symmetrisch, der zweite Finger ist der längste, der dritte und vierte Finger sind beinahe gleich lang. Man findet an jedem Finger nur zwei Phalangen, an den Daumen ist der proximale Phalanx so klein, dass man »genauer hinsehen muss» um diesen nachzuweisen. An der Volarfläche jeden Fingers findet man nur eine Biegungsfurche.

Die Kraft in den Händen ist gut, ebenso die Beweglichkeit der Finger, sämtliche Fingerpulpae können die Handfläche berühren.

Die Füsse sind sehr kurz, besonders die Zehen sind kurz und plump, und auch hier kann man nur zwei Phalangen an jeder Zehe nachweisen.

Der Patient hat sich in jüngeren Jahren ausschliesslich durch manuelle Arbeit ernährt: Matrose, später Koch und Hofmeister, und selbst wenn es ihm auch oft schwer fiel schwere Gegenstände festzuhalten, hat er sich doch gut durchgebracht. Der Gang war immer gut gewesen.

Nach den Angaben des Patienten haben sowohl Vater als Mutter und die Eltern der Mutter normale Hände gehabt — über die älteren Generationen konnten keine Angaben beschafft werden. Der Patient hat sechs Brüder und eine Schwester, doch keines dieser Geschwister hat an Händen und Füssen Missbildungen. Der Patient hat einen Sohn, der auch keine Deformität irgendwelcher Art weder an Händen noch Füssen besitzt.

Auf dem Röntgenbild der Hände (Fig. 1) sieht man, dass die ganze Hand ausserordentlich kurz ist, beide Hände sind im grossen und gan-

[1] Bei der Redaktion am 25. X. 1933 eingegangen.

Fig. 1.

Fig. 2.

zen symmetrisch, die Handwurzelknochen sind normal, sämtliche Metacarpalknochen sind kurz, plump, der zweite ist der längste, der dritte ist wenige mm kürzer als der vierte Metacarpalknochen. Es finden sich nur zwei Phalangen an jedem Finger, der Grundphalanx am ersten Finger ist sehr kurz, er ist 12 mm hoch und breit, am zweiten, dritten, und vierten Finger der rechten Hand, samt am zweiten und dritten Finger der linken Hand ist zwischen den Metacarpalknochen und Phalangen bis zu 9 mm Diastase, und in jedem von diesen Zwischenräumen sieht man etwas verschiedenartige, recht kompakte Knochenschatten bis zu Erbsengrösse. Man ist geneigt diese Knochenschatten als Reste der fehlenden Grundphalangen aufzufassen, hiergegen aber spricht, dass die Basis der proximalen Phalangen eine konkave Gelenksfläche als Grundphalanx und nicht wie normalerweise beim zweiten Phalanx eher eine konvexe Gelenksfläche hat. Sowohl die proximalen als distalen Phalangen sind kurz und breit, die distalen Phalangen am zweiten — fünften Finger auf beiden Seiten haben höhere und breitere Basalparteien als normal, und an einzelnen sieht man ungefähr 5 mm distal von der Gelenksfläche eine dunkle Querlinie. Leichte Subluxation im Interphalangealgelenk beider vierten Finger, der distale Phalanx ist etwas radial gedreht.

Auf dem Röntgenbild der Füsse (Fig. 2) sieht man, dass die Metatarsalknochen, abgesehen vom Capitulum an beiden zweiten Zehen, wo die Gelenksfläche konkav anstatt konvex ist normale Länge und Form aufweisen. Man findet nur zwei Phalangen an jeder Zehe, und diese Phalangen sind sehr kurz und plump, besonders der Grundphalanx der ersten Zehe, dieser ist 14 mm hoch und 20 mm breit.

Der hier mitgeteilte Fall weicht in vielen Punkten so sehr von den in den Übersichtsarbeiten von POL[1] und POLITZER[2] mitgeteilten Fällen ab, dass eine Veröffentlichung berechtigt erscheint.

PFITZNERS normale Durchschnittszahl für den »Fingerstrahl» (= Metacarp + Phalangen) gilt für ersten bis fünften Finger beziehungsweise 96, 145, 143 und 121 mm; für diesen Patienten, der 160 cm hoch ist, betragen die Zahlen beziehungsweise 78, 110, 100, 105 und 79 mm, es handelt sich also um Brachydactylie in recht ausgesprochenem Grad.

Für angeborene Anomalie der Hand gilt im Allgemeinen folgende Skala: V, II, IV, III, so dass der fünfte Finger zuerst und am ärgsten angegriffen wird, der dritte Finger zuletzt und am wenigsten abgesehen vom ersten Finger. In diesem Fall ist der dritte Finger am meisten reduziert und zwar in der Länge, ja selbst der dritte Metacarpalknochen

[1] POL.: Brachydactylie, Klinodactylie und Hyperdactylie. Vierch. Arch. 229. 1921. Pag. 388. Hier ausführliche Literatur.

[2] POLITZER: Fortschr. Röntgenstr. 43. 1931. Pag. 605.

ist im Verhältnis zu den übrigen Mittelhandknochen verkürzt obwohl die Metacarpalknochen bei Anomalien der Hand nur selten affiziert erscheinen.

Ohne auf die Genese der Missbildung näher einzugehen, erwähne ich, dass in allen mitgeteilten Hypophalangiefällen der mittlere Phalanx fehlt. Bei mindergradigen Anomalien findet man Assimilationshypophalangie; ein kleinerer, rudimentärer Mittelphalanx ist mit der Basis des distalen Phalanx, dessen basaler Teil deshalb breiter und länger wird, ossös verbunden, manchmal sieht man zwischen den 2 Teilen die Verbindungslinie.

Der mitgeteilte Fall lässt annehmen, dass die kleinen Knochenstücke, die sich zwischen die Metacarpalknochen und proximalen Phalangen der fünf Finger eingeschoben finden, als Reste des Grundphalanx aufgefasst werden müssen, so dass man in diesem Fall gegenüber einem Mangel an Grundphalanx steht.

Dem Umstand, dass die basale Gelenksfläche der proximalen Phalangen die gleiche Form wie die der Grundphalanx hat, kann man wohl kaum eine grössere Bedeutung zuschreiben, da es bei angeborenen Anomalien wohl kaum unwahrscheinlich ist, dass die Gelenksflächen die zweckmässigste Form annehmen können; andererseits aber hat man vorher niemals Mangel an Grundphalanx nachgewiesen, selbst wo eine sehr grosse Anzahl von Hypophalangiefällen vorliegt. Die Basis des Aussenphalanx ist hier recht breit und hoch, an ein Par Stellen sieht man die Querlinien; man kann nicht ausschliessen, dass das Bild den Verhältnissen bei Assimilationshypophalangie ähnlich ist; in solchem Fall müssen die genannten Knochenstücke, die man zwischen Metacarpalknochen und Phalangen sieht als Epifysenkerne in den Metacarpalknochen aufgefasst werden, doch lässt das Capitulum auf dem genannten Mittelhandknochen diese Möglichkeit kaum gelten.

Welche von den genannten Deutungen die richtige ist kann man nicht sagen, aber es ist wohl am wahrscheinlichsten, dass von einem Mangel an Grundphalanx die Rede ist.

Im Gegensatz zu der Mehrzahl der früher veröffentlichten angeborenen Handanomalien, hat man hier in der Familie des Patienten keine ähnlichen Veränderungen nachweisen können, gewiss könnten nur Angaben über die Eltern und Grosseltern (mütterlicherseits) des Patienten beschafft werden, und deshalb kann man die Annahme einer erblichen Missbildung kaum ausschliessen.

## ZUSAMMENFASSUNG

Ein Fall von einer nicht vorher veröffentlichen Art von Hypophalangie der Hände und der Füsse wird mitgeteilt und Bilddeutung diskutiert.

## SUMMARY

The author reports a case of hypophalangism of the hands and feet, of a type not before described, and discusses the interpretation of the roentgenographs of the same.

## RÉSUMÉ

L'auteur présente et discute les radiographies d'une forme non encore publiée d'hypophalangie des mains et des pieds.

AUS DER RÖNTGENABTEILUNG (VORSTAND: CHEFARZT ÅKE ÅKERLUND) UND DEM PATHOLOGISCHEN LABORATORIUM (VORSTAND: DOKTOR FREDRIK WAHLGREN) AM MARIA-KRANKENHAUSE ZU STOCKHOLM

# RÖNTGENOLOGISCHE UND PATHOLOGISCH-ANATOMISCHE VERÄNDERUNGEN BEI ERWEITERUNGEN EINZELNER NIERENKELCHE[1]

von

*Karl Östling*

(Tabulæ XI—XII)

Unter den isolierten Kalyxerweiterungen fanden die bei frühen Stadien von Nierentuberkulose vorkommenden am meisten Beachtung. Sie entstehen durch Zerfall von Herden in den Pyramiden oder sekundär nach tuberkulösen Kalyxstenosen, und haben mitunter auf Pyelogrammen ein charakteristisches Aussehen. In anderen Fällen können Erweiterungen einzelner Kalyzes als eine prästenotische Dilatation peripher von einer komprimierenden Zyste oder einem Tumor entstehen. In wieder anderen Fällen liegt die Ursache in einem obturierenden Stein oder Nierenbeckentumor. Vereinzelte Male wurden partielle Erweiterungen in Form von grossen, dünnwandigen Hydronephrosesäcken beobachtet, und schliesslich sind Fälle beschrieben, in welchen eine Nierenzyste in das Nierenbecken perforiert oder von diesem ausgegangen war.

Ausser den hier aufgezählten Typen gibt es indes andere, nicht eben seltene, aber bisher wenig beachtete Formen von isolierten Kalyxerweiterungen. So kommen mitunter in Fällen mit chronischer Harnwegsinfektion auf Pyelogrammen sichtbare Erweiterungen vor, die einzelne Kalyzes betreffen.

Im folgenden sei über zwei solche Fälle mit bemerkenswerten Röntgenbefunden berichtet. Vom pathologisch-anatomischen Standpunkte sind die Veränderungen — besonders in Bezug auf ihre Genese — von Interesse.

[1] Bei der Redaktion am 11. XII. 1933 eingegangen.

Drei ähnliche Fälle ohne nachweisbare Nierenbeckeninfektion ergänzen das Material. Von diesen Fällen wurde nur einer röntgenuntersucht, während die beiden anderen von Obduktionen stammen.

*Fall I.* Nr. 2687. Frau O. O., 30 Jahre alt.

In den letzten 7 Jahren wiederholt akute Erkrankungen mit Schmerzen in der rechten Nierengegend, Frösteln und hohem Fieber. In den Intervallen zwischen den Anfällen symptomfrei.

Am 11. XII. 1926 wurde Pat. während eines Schmerzanfalles in die chrirurgische Abt. des Mariakrankenhauses aufgenommen. Temperatur 38.7. Palpationsempfindlichkeit und Muskelabwehr in der rechten Nierengegend. Der Harn war trübe und enthielt Massen von weissen Blutkörperchen und B. coli.

*Zystoskopierung:* Die Blasenschleimhaut mässig gerötet, sonst aber ohne bemerkenswerte Veränderungen. Von der rechten Niere erhielt man bei Kompression des Organs einige stark getrübte Tropfen, die reichlich Eiterzellen und Kolibakterien enthielten. Wiederholte Untersuchungen auf das Vorkommen von Tbc.-Bazillen im Harn fielen negativ aus.

*Röntgenuntersuchung.* Auf der linken Seite sieht man einen Nierenschatten von normaler Form und Grösse. — Rechte Niere: Der untere Nierenpol weist eine bedeutende Schrumpfung auf, sonst hat der Nierenschatten normale Form und Grösse. In der geschrumpften Partie befindet sich eine spanischnussgrosse Zusammenballung, die aus kleineren, kalkdichten Flecken zusammengesetzt erscheint (Fig. 1). Bei Vornahme retrograder Pyelographie auf der rechten Seite (zu zwei verschiedenen Zeiten) wurde eine gute Kontrastfüllung von Kalyzes normalen Aussehens im oberen und mittleren Teil der Niere erhalten. Der Kalyx, der offenbar dem unteren Nierenpol entsprach, wies dagegen nur eine Ausfüllung des basalen Teiles in Form eines kurzen Zapfens auf.

Gestützt auf die im unteren Pol der rechten Niere auf den Röntgenbildern beobachteten Veränderungen — die Schrumpfung, der kalkartige, zusammengeballte und fleckenförmige Schatten, sowie die mangelhafte Ausfüllung des entsprechenden Kalyx — wurde die Diagnose rechtsseitige Nierentuberkulose gestellt.

Am 4. I. 1927 *rechtsseitige Nephrektomie* (Dr. B. Bager).

Am 29. I. 1927 wurde Pat. geheilt entlassen.

*Präparatbeschreibung* (Fig. 2). Die Niere besteht aus einem grossen Oberteil vom Aussehen einer normalen Niere, und einem unteren, kaum taubeneigrossen Teil, der an der hinteren und medialen Nierenfläche durch eine deutliche Furche gegen den oberen Teil abgegrenzt ist. Auf einem Frontalschnitt, der von der konvexen Oberfläche aus zum Hilus geführt wird, sieht man im oberen Teile ein graziles Nierenbecken und regelmässig geformte Kalyzes. Die Nierenbeckenschleimhaut ist leicht verdickt und zeigt einige kleinere Blutungen. In der taubeneigrossen Nierenpartie findet sich ein spanischnussgrosser Hohlraum, in dessen Wand einige rundliche Erhöhungen sichtlich Reste von Nierenpapillen vorstellen. Dieser Hohlraum steht mit dem Nierenbecken durch einen Kalyx in Verbindung, dessen sonst normal weites Lumen bei der Einmündung in die Höhle eine zirkuläre Striktur aufweist, die nur eine Stricknadel durchlässt. Die Höhle ist von einer breiähnlichen Masse ausgefüllt; diese besteht aus hanfsamengrossen und kleineren dunkelroten, spröden, kugelförmigen Gebilden, die mit kleinen, harten, gelbbraunen, sandkornähnlichen Partikeln gemischt sind. Der Hohlraum ist von einer millimeterbreiten, graugelatinösen, rauhen Gewebeschicht ausgekleidet.

Bei *mikroskopischer Untersuchung* zeigt sich, dass die Nierenbeckenschleimhaut im oberen Teil des Beckens leicht chronisch entzündlich verändert ist. In den entsprechenden Teilen der Niere sieht man verstreut kleine Bindegewebsnarben in der Rinde mit hyalinisierten Glomeruli und spärlicher Rundzelleninfiltration. Die Wand des haselnuss-

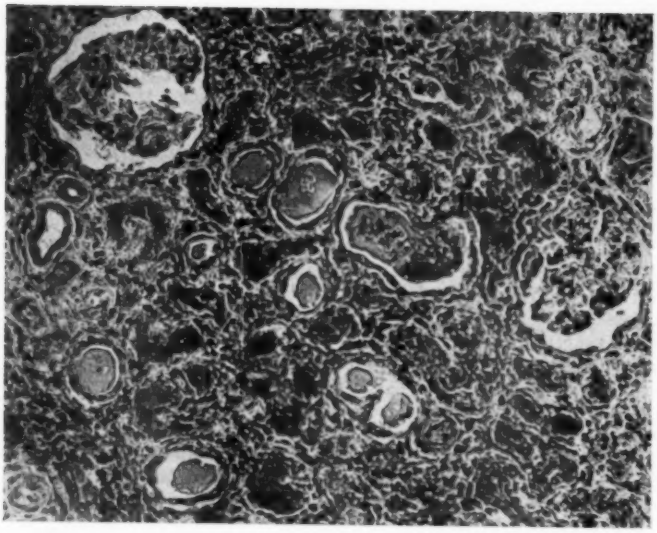

Fig. 3.

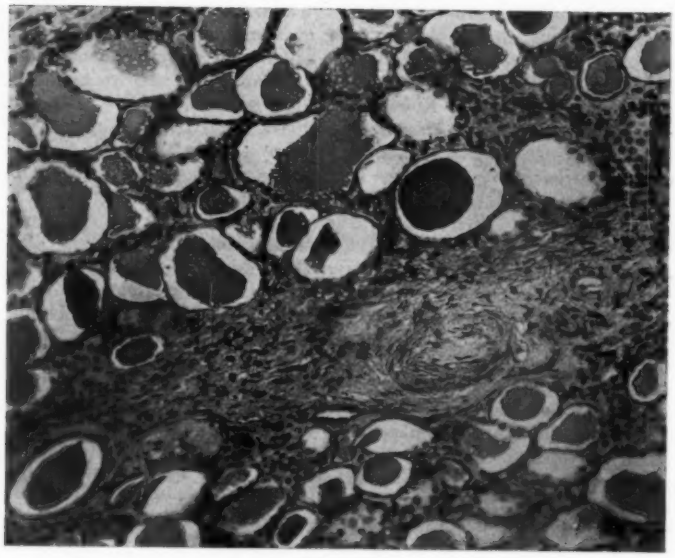

Fig. 4.

grossen Hohlraumes besteht aus einem zellarmen, kollagenen Bindegewebe und ist auf der Innenseite mit Übergangsepithel bekleidet. Die verschiedenen Schichten der Wände sind in grösserer oder geringerer Ausdehnung von entzündlichen Zellen — Rundzellen und Fibroblasten durchsetzt sowie von verstreuten Riesenzellen, die am ehesten dem Fremdkörper-Riesenzellen-Typus nahekommen. Epitheloidzellen oder andere an Tuberkeln erinnernde Strukturen sind nirgends zu finden. In den nach ZIEHL-NIELSEN gefärbten Präparaten waren keine Tbc.-Bazillen nachweisbar. Der dieses Gebiet umgebende Teil des Nierenparenchyms ist teilweise gut erhalten, während andere Teile stark narbig verändert sind, mit hyalinisierten, dicht liegenden Glomeruli, sklerosierten

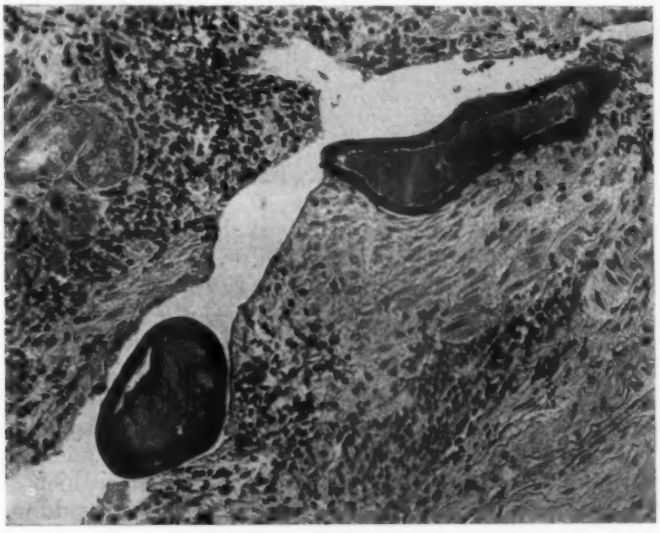

Fig. 5.

Gefässen und einzelnen Kanälen mit niedrigem, atrophischem Epithel sowie reichlichen Rundzelleninfiltraten. An einigen Stellen sind die Lumina der Kanäle von kolloiden Massen angefüllt (Fig. 3). — Fig. 4 zeigt einen Teil des Gewebes, wo die dicht an einander liegenden, von kolloiden Massen ausgefüllten und ausgedehnten Kanäle dem Bilde ein stark an Thyreoideagewebe erinnerndes Aussehen verleihen. — Der breiige Inhalt besteht aus amorphen Massen mit stellenweise feinfaseriger Struktur nebst verstreuten feinen Körnern mit einer dünnen hyalinen Schale und Zellschatten innerhalb der Schale (Fig. 5).

*Chemische Untersuchung:* Der Inhalt bestand zum grösseren Teile aus organischer Substanz, aus der mit Sicherheit nur Blutfarbstoff identifiziert werden konnte. Ausserdem wurde Kalzium- und Magnesiumphosphat in mässiger Menge nachgewiesen; Harnsäure, Kohlensäure, Oxalsäure und Ammoniak dagegen nicht (Prof. E. HAMMARSTEN).

Die pathologisch-anatomischen Veränderungen sollen im Zusammenhange mit den übrigen Fällen berührt werden, hier will ich mich nur mit dem Röntgenbefund beschäftigen. Der spanischnussgrosse, kalk-

artige, wolkige und streifige Schatten im unteren Nierenpol lenkt hier das grösste Interesse auf sich.

Es gibt eine Menge verschiedener Arten von röntgendichten Schatten im Nierenparenchym. Mitunter handelt es sich um Parenchymkonkremente, in anderen Fällen um Verkalkungen bei Nierentuberkulose. In selteneren Fällen können sie durch Kalkinkrustationen in der Nierenbeckenwand bedingt sein — Pyelitis calculosa (ÅKERLUND), metaplastische Knochenneubildungen in der Nierenbeckenwand — Pyelitis ossificans (HELLSTRÖM), Kalkinfarkte (KNUTSSON), verkalkte Blutkoagula in einer hydronephrotischen Niere (ÅKERLUND), Gefässverkalkungen (WINTHROP und HALLOCK), Kalkinkrustationen in Zystenwänden sowie Verkalkungen in Parasiten.

Von diesen sind die tuberkulösen Verkalkungen die häufigsten. Sie sind im allgemeinen wolkig und streifenförmig und den Pyramiden entsprechend gelegen. Gewisse Verfasser, u. a. SÖDERLUND, hielten sie für patognomonisch.

Die Diagnose rechtsseitige Nierentuberkulose gründete sich in diesem Falle auf das gleichzeitige Vorkommen dreier auf den Röntgenbildern beobachteten Veränderungen: der Schrumpfung des unteren Nierenpols, des fleckigen und streifenförmigen Verkalkungsherdes in dieser Partie sowie der mangelhaften Ausfüllung des entsprechenden Kalyx bei retrograder Pyelographie.

Die Untersuchung der exstirpierten Niere ergab indes, dass es sich nicht um eine Tuberkulose handelte. Entsprechend den röntgenologischen Veränderungen fand sich im geschrumpften unteren Nierenpol ein spanischnussgrosser Hohlraum, der eine breiartige Masse enthielt. Mit dem Nierenbecken stand die Höhle durch einen Kalyx in Verbindung, der eine hochgradige Striktur aufwies. Der Inhalt bestand aus hanfsamengrossen und kleineren, dunkelroten, brüchigen, kugelförmigen Gebilden und aus hellgelben, harten Körnern. Bei mikroskopischer Untersuchung zeigte sich, dass er aus amorphen Massen sowie Körnern mit einer hyalinen Schale und Schatten von Zellen innerhalb der Schale bestand. Eine chemische Analyse wies Blutfarbstoff sowie Kalzium- und Magnesiumphosphat nach.

Der auf den Röntgenbildern sichtbare, kalkartige Schatten war also in diesem Falle durch die in den Hohlräumen liegenden Partikel bedingt. Ihre Genese ist nicht gänzlich klar, wahrscheinlich dürfte es sich hier aber um verkalkte Blutkoagula handeln.

*Fall 2.* Nr. 43. 1933. Fr. A. N., 24 Jahre alt.

Pat. hatte seit dem Jahre 1922 ab und zu Zystopyelitisbeschwerden mit Temperatursteigerungen und Harndrang gehabt. Bei Untersuchung im Jahre 1926 wurde im Harn Koliinfektion konstatiert, derentwegen Pat. dann wiederholt behandelt wurde. Tbc.-Bazillen wurden niemals nachgewiesen. Im Jahre 1930 brannte man ein haselnuss-

Fig. 11.

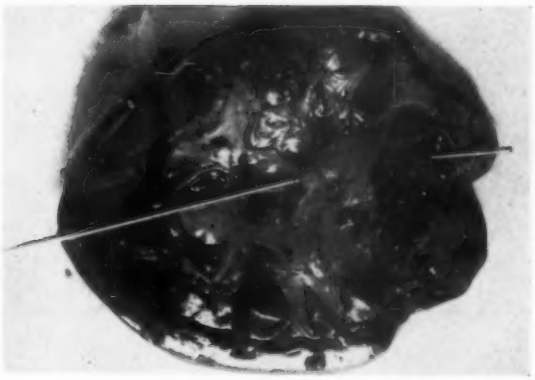

Fig. 2.

Fig. 1.

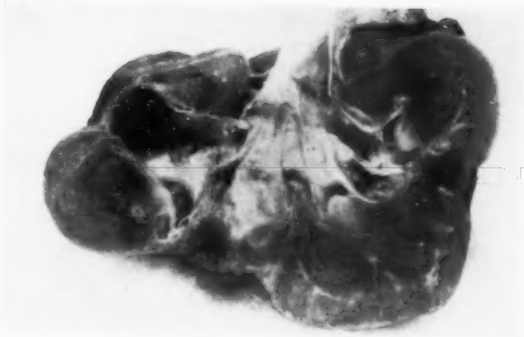

Fig. 8.

Fig. 7.

Fig. 6.

grosses Blasenpapillom ab, das nächst der linken Uretermündung sass. — Im November 1932 setzten wieder Zystitisbeschwerden ein. Am 7. XII. Aufnahme ins Mariakrankenhaus. Im Harn wurden spärlich weisse Blutkörperchen und B. coli nachgewiesen; keine Tbc.-Bazillen.

*Röntgenuntersuchung:* (Übersichtsbilder, intravenöse und retrograde Pyelographie). Der linke Nierenschatten hat eine normale Form. Bei Vornahme retrograder Pyelograpie füllte sich ein graziles Nierenbecken mit normal geformten Kalyzes aus. — Der rechte Nierenschatten ist in seinem unteren Teile breiter. In der Kontur sieht man zwei Einziehungen, eine am unteren Pol und eine unmittelbar über der Mitte des lateralen Randes. Vom rechten Nierenbecken, das zusammen mit dem unteren und den mittleren Kalyzes eine Einheit bildet, verläuft ein langer Kalyx major nach oben. Dieser Kalyx ist in seinem oberen Teil gross und plump und reicht fast bis zur Nierenkontur. Nächst seinem lateralen Teil sieht man eine kleine, reiskorngrosse, freiliegende Kontrastansammlung. Der obere von den mittleren Kalyzes ist rundlich und plump und macht den Eindruck eines erbsengrossen, durch eine zirkuläre Einziehung vom übrigen Nierenbecken abgetrennten Hohlraumes mit gleichmässigen Wänden. Die anderen Kalyzes haben normales Aussehen (Fig. 6).

Am 10. I. 1933 rechtsseitige Nephrektomie (Prof. E. Key). 2 Wochen danach wurde Pat. geheilt entlassen.

*Präparatbeschreibung.* Die rechte Nierenoberfläche weist mehrere narbige Einziehungen auf, die in vier Gruppen angeordnet sind, je eine im oberen und unteren Pol und zwei dicht nebeneinander an der lateralen Nierenoberfläche (Fig. 7). Ein medianer Sektionsschnitt durch die Niere (Fig. 8) gibt einen Überblick über die Kalyxveränderun-

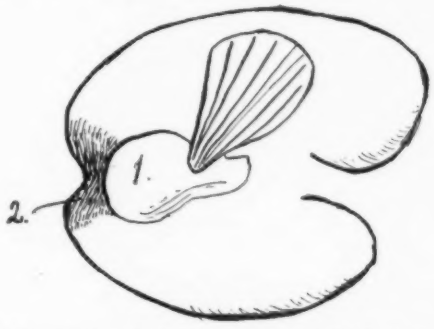


Fig. 9. Schematische Zeichnung eines horizontalen Schnittes durch die Niere im Niveau des oberen von den mittleren Kalyzes.

1. Der dilatierte und blind endigende Kalyx, in dessen hintere Wand eine Papille mündet.
2. Narbe.

gen, die den Narben auf der Oberfläche entsprechen. Eine Klappenbildung (Wandduplikatur) im oberen Kalyx unmittelbar nächst dessen Abgang vom Nierenbecken bewirkt eine hochgradige Verengerung des Lumens. Peripher von dieser Stelle erweitert sich das Lumen rasch und bildet medial einen grösseren Hohlraum mit etwas ungleichmässigen Wänden und granulierter Schleimhaut. Die Dicke des Nierenparenchyms variiert hier zwischen 2 mm und gut ½ cm. Lateral davon hat das Lumen das Aussehen eines normalen Kalyx, und hier sieht man eine normale Nierenpapille. Vom äusseren Fornix dieser Papille führt ein nadelfeiner, millimeterlanger Gang in einen unmittelbar an eine Pyramide grenzenden, reiskorngrossen Hohlraum. Der obere von den mittleren

Kalyzes ist gleichfalls krankhaft verändert. Ungefähr in der Mitte seiner hinteren Wand mündet eine Papille mit peripher gerichteter Spitze, und hier erweitert sich das Lumen und bildet einen Blindsack, dem eine narbige Einziehung auf der Oberfläche entspricht. (Fig. 9.) Dieser Kalyx ist nicht strikturiert. Der eine Fornix des unteren Kalyx zeigt entsprechend der hier gelegenen Narbe eine etwas plumpe Ausziehung.

*Mikroskopische Untersuchung.* Das Epithel ist überall gut erhalten und weist in den erweiterten Kalyxpartien stellenweise kleine Proliferationen auf, teils nach aussen, teils nach innen (Pyelitis cystica). Am Platze der Einziehungen und Kalyxveränderungen ist das Nierenparenchym narbig umgewandelt. Hier findet sich ein thyreodeaähnliches Gewebe (Fig. 10) mit Hohlräumen, die ein niedriges Epithel haben und kolloidale Massen enthalten, sowie hochgradig sklerosierte Gefässe, Reste von Kanälen und vereinzelte hyalinisierte Glomeruli. In diesen Gebieten und vor allem in der Kalyxwand sieht man eine reichliche Rundzelleninfiltration. Die Grenze zum normalen Nierengewebe ist mitunter scharf ausgesprochen, manchmal ist der Übergang mehr diffus. — Sonst weist das Nierenparenchym keine bemerkenswerten Veränderungen auf.

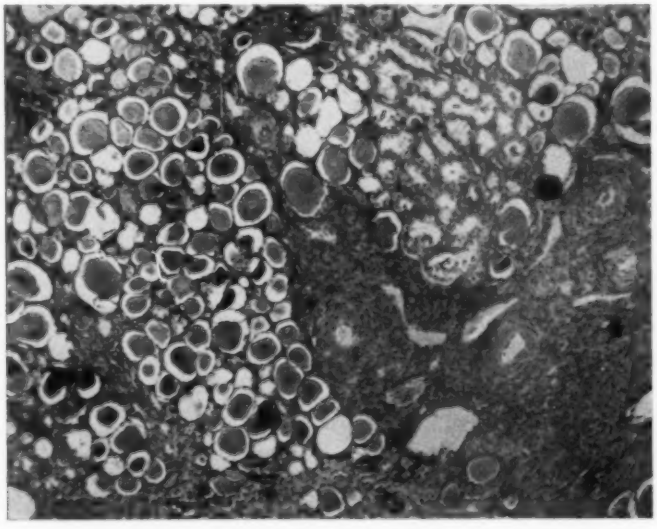

Fig. 10.

Den auf dem Röntgenbilde sichtbaren Einziehungen der Nierenkontur entsprechen auf der Oberfläche breite Narben. Ebenso finden die auf dem Pyelogramm sichtbaren Kalyxveränderungen ihre anatomische Erklärung in dem Präparat. So entspricht der unregelmässigen Erweiterung des oberen Hauptkalyx eine fast walnussgrosse Höhle und dem reiskorngrossen Kontrastflecken ein kleiner, nächst einer Nierenpyramide gelegener Hohlraum. Der äusserst schmale, den letztgenannten Hohlraum mit dem oberen Kalyx verbindende Gang, der in den Fornix der angrenzenden Papille mündet, war jedoch zu fein, um auf dem

Pyelogramm einen Schatten hervorrufen zu können. Die Erweiterung des oberen der mittleren Kalyzes entspricht der auf dem Pyelogramm sichtbaren plumpen Auftreibung, und die zirkuläre Einziehung ist durch die in die hintere Kalyxwand einmündende, lateral gerichtete Papille bedingt (vgl. Fig. 9). Die Erweiterungen waren überall von einer teilweise granulierten Schleimhaut bekleidet.

Fig. 12.

In der Röntgenliteratur ist, soweit ich finden konnte, bisher kein solcher Fall beschrieben worden.

Wenn es sich um die röntgenologische Differentialdiagnose gegen isolierte Kalyxdilatationen anderer Art handelt, kommen in diesem Falle zunächst die in frühen Stadien von Nierentuberkulose vorkommenden lokalen Kalyxerweiterungen in Frage. Diese haben ein stark variierendes Aussehen, mitunter können sie aber, gewöhnlich durch ihre zernagten Konturen, auf Pyelogrammen typische Bilder geben.

Der reiskorngrosse Kontrastflecken nächst dem oberen Kalyx sowie die Erweiterung des oberen von den mittleren Kalyzes waren so gelegen, dass man hätte denken können, sie seien durch tuberkulöse Pyramidendestruktionen entstanden. Wenn dies der Fall gewesen wäre, hätten indes von der letzteren, in offener Kommunikation mit dem Nierenbecken stehenden Erweiterung Tuberkelbazillen mit dem Harn ausgeschieden werden müssen. Gegen tuberkulöse Destruktion sprach ferner, dass die Kontrastansammlungen scharfe und gleichmässige Konturen hatten. Diese Momente liessen die Diagnose Nierentuberkulose unwahrscheinlich erscheinen.

Auf dem intravenösen Pyelogramme von einem anderen Falle (Nr. 3) ohne Harnwegssymptome und mit negativem Harnbefund findet man am Platze des zweitobersten Kalyx in der rechten Niere ähnliche Veränderungen wie im Falle 2. Das Kontrastmittel hat sich hier zu einem erbsengrossen Flecken angesammelt, der näher an die Oberfläche reicht als die unterhalb von ihm liegenden Kalyzes. Diesem Fleck entspricht in der lateralen Kontur eine seichte Einziehung (Fig. 11). Ein kaum wahrnehmbarer Schatten entspricht wahrscheinlich der Verbindung mit

dem Nierenbecken. Die Übereinstimmung zwischen den röntgenologischen Befunden in den beiden Fällen ist so gross, dass man zur Annahme berechtigt sein dürfte, es handle sich hier um gleichartige pathologisch-anatomische Veränderungen.

Nachdem ich im Anfang dieses Jahres aus Anlass des als Nr. 2 beschriebenen Falles meine Aufmerksamkeit auf Nierenveränderungen ähnlicher Art gerichtet hatte, habe ich durch ein paar Monate bei den am Mariakrankenhause ausgeführten Obduktionen die Nieren von diesem Gesichtspunkte untersucht. Bei zwei Fällen wurden dabei in der einen Niere

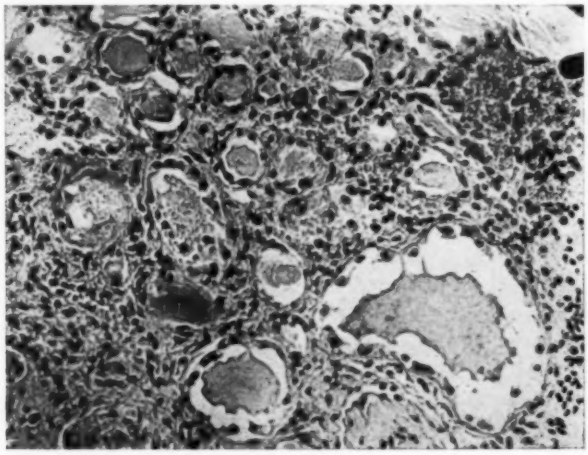

Fig. 13.

derartige Veränderungen gefunden. Beide Male handelte es sich um normalgrosse Nieren ohne andere makroskopische Veränderungen oder Zeichen einer Pyelitis.

Der eine Fall (Nr. 4) wird durch Fig. 12 veranschaulicht. Hier liegt eine narbige Einziehung der Nierenoberfläche vor, und im entsprechenden Teil des Nierenparenchyms findet man bei mikroskopischer Untersuchung an Thyreoideagewebe erinnernde Bilder von ähnlichem Aussehen wie die bei den beiden vorigen Fällen beobachteten (Fig. 13). Der nächst der veränderten Gewebepartie liegende Teil des Fornix ist abgerundet, eine eigentliche Kalyxerweiterung besteht aber nicht.

Im anderen Falle (Nr. 5) hatten die Veränderungen die gleiche Lokalisation, und hier fand sich, entsprechend der Narbe, eine knospenförmige Kalyxerweiterung. Dieser Kalyx bekam dadurch ein Aussehen, das dem Bilde des zweitobersten Kalyx im Falle 2 gleicht (Fig. 9). In diesem Falle wurde keine mikroskopische Untersuchung vorgenommen.

## Pathologische Anatomie

Wenn es sich darum handelt, die Genese der Veränderungen bei den in Rede stehenden Fällen näher zu analysieren, so dürfte es zweckmässig sein, vorerst zu versuchen die Genese und Bedeutung des in den drei mikroskopisch untersuchten Nieren (Fall Nr. 1, 2 und 4) nachgewiesenen *thyreoideaähnlichen Gewebes* klarzustellen.

Das Vorkommen eines solchen Gewebes in der Niere wurde schon früher von ASK-UPMARK, STAEMMLER und DOPHEIDE sowie PFEIFFER beschrieben. Mehr im Vorbeigehen wird es auch von einigen anderen Verfassern erwähnt.

Bei 7 Fällen fand ASK-UPMARK in Nieren, die von Obduktionsmaterial stammten, blind endigende Nierenbeckenvertikel. Auf der Oberfläche hatte ihnen eine narbige Einziehung entsprochen, unter der das Parenchym das Bild eines schilddrüsenähnlichen Gewebes aufgewiesen hatte, in welchem keine Reste von Konvoluten und Glomeruli nachgewiesen werden konnten. Diese Veränderungen waren oft doppelseitig und in 5 Fällen in Zusammenhang mit maligner Nephrosklerose vorgekommen. ASK-UPMARK fasst sie als Missbildungen auf und führt als Grund hierfür unter anderem das regelmässige Vorkommen der Divertikel in der mittleren und unteren Partie der Niere nächst dem Ureter an, an welchen Stellen während der Entwicklung vielleicht am leichtesten Hemmungsbildungen entstehen könnten. Ferner sprechen für diese Erklärung der Divertikel deren Vorkommen in hypoplastischen Nieren und das Verhalten, dass in dem thyreoideaähnlichen Gewebe keine Reste von Nierenparenchym gefunden wurden. Die Annahme einer Missbildung in diesen Fällen scheint sehr verlockend, wenn auch nicht sicher bewiesen.

STAEMMLER, DOPHEIDE und PFEIFFER beobachteten thyreoideaähnliches Gewebe in pyelonephrotischen Schrumpfnieren von charakteristischem Aussehen. Sie wiesen auf der Oberfläche breite Einziehungen auf, und zwischen diesen kleinknollige Erhöhungen. Das Kalyxsystem war diffus erweitert und zeigte Zeichen einer chronischen Entzündung. Auf verschiedenen Präparaten konnten die Verf. die Entwicklung des schilddrüsenähnlichen Gewebes aus normalem Nierenparenchym verfolgen, und sie unterschieden dabei schematisch vier Stadien. Die Verwandlung begann mit einer Atrophie der Harnkanäle und Rundzellenanhäufung im interstitiellen Gewebe. Im zweiten Stadium wurden die Glomeruli hyalinisiert und degeneriert, und im dritten Stadium erweiterten sich die Kanäle und füllten sich mit kolloiden Massen. Im Endstadium bestand das Gewebe aus einzelnen Kolloidzysten in einem gefässarmen Bindegewebe, in welchem die Glomeruli vollständig fehlten.

In einem Fall von Schrumpfniere, den ich beobachten konnte, war die Genese anderer Art. Die Ursache der Schrumpfung war in diesem Falle

eine Thrombose in der Arteria renalis. In dieser Niere kamen dieselben an Thyreoideagewebe erinnernden mikroskopischen Bilder vor wie in den oben beschriebenen Fällen.

Es erscheint wahrscheinlich, dass in denjenigen Fällen, wo die Möglichkeit einer Missbildung ausgeschlossen werden kann, *ein langsam vorsichgehender Untergang von Nierenparenchym die wesentliche Bedingung für die Entstehung des thyreoideaähnlichen Gewebes ist.* Dieser Parenchymuntergang kann seinerseits durch verschiedene ätiologische Momenten hervorgerufen werden, so durch pyelonephritische Prozesse und Gefässthrombosierungen.

Was das eigene geringe Material betrifft, so möchte ich mir keine Schlüsse über die Genese des schilddrüsenähnlichen Gewebes bei den in Rede stehenden Fällen erlauben. Ich will mich hier beschränken darauf hinzuweisen, dass die variierenden makroskopischen Bilder, auf welchen man die Entwicklung des thyreoideaähnlichen Gewebes aus Nierenparenchym beobachten (Fall 1 [Fig. 3] und Fall 4 [Fig. 13]) oder Reste von Nierenparenchym in den veränderten Partien (Fall 2, Fig. 10) nachweisen kann, einigermassen gegen die Missbildungstheorie sprechen können. Ferner sei hervorgehoben, dass in den Fällen 1 und 2 eine chronische Harnwegsinfektion vorlag, während man im Falle Nr. 4 keine sicheren Pyelitisveränderungen beobachten konnte.

Was die Genese der in drei von den vier pathologisch-anatomisch untersuchten Nieren (Fall 1, 2 und 5) vorkommenden *Kalyxerweiterungen* betrifft, so erlaubt das makroskopische Bild gewisse Schlüsse.

Während man auf Grund der Veränderungen im Falle I, der ausgesprochenen Kalyxstriktur und der rundlichen Form des Hohlraumes mit der Möglichkeit rechnen muss, dass die Erweiterung zum wesentlichen Teil als eine prästenotische Dilatation aufzufassen ist, gilt dies nicht von den Fällen Nr. 2 und 5, was am besten durch die im obersten Kalyx des Falles 2 vorliegenden Verhältnisse bewiesen ist. Die Klappenbildung in diesem mag natürlich ein gewisses Hindernis für den Abfluss gebildet haben, die peripher davon liegende Erweiterung kann aber kaum durch sekundäre Dilatation entstanden sein. Das makroskopische Aussehen des Hohlraumes spricht gegen eine solche Entstehungsweise. Lateral sieht man nämlich eine Partie von Kalyxcharakter, die mit einer gut entwickelten Papille endigt, und medial geht diese Partie in die fast walnussgrosse Höhle mit ihren ungleichmässigen Wänden über. In diesen Fällen müssen wir nach einer anderen Erklärung für die Entstehung der Erweiterungen suchen. Die hierfür in Frage kommenden Möglichkeiten sind: entweder Untergang von Nierenparenchym mit Schrumpfung und sekundärer Ausziehung der Kalyxwand oder das Vorliegen einer Missbildung. Dass die Erweiterungen und das thyreoideaähnliche Gewebe in diesen Fällen eine einheitliche Genese haben, scheint ausser allem

Zweifel zu stehen, während die Verhältnisse im Falle I in dieser Beziehung nicht ganz klar sind.

Was schliesslich die *klinische Bedeutung* der Veränderungen betrifft, so sei nur hervorghoben, dass Kalyxerweiterungen der in Rede stehenden Art natürlich dazu beitragen, eine Harnwegsinfektion aufrechtzuerhalten.

## ZUSAMMENFASSUNG

Verf. berichtet über zwei Fälle (1 und 2) von isolierten Kalyxerweiterungen, die im Hinblick auf die röntgenologische Differentialdiagnose gegen Nierentuberkulose besonderes Interesse bieten.

Im ersten Falle fand sich im unteren Pol der exstirpierten Niere ein Hohlraum, der mit dem Nierenbecken durch einen strikturierten Kalyx in Verbindung stand. In diesem Hohlraum war eine Masse, die wahrscheinlich aus verkalkten Blutkoagula bestand.

Zwei Fälle (4 und 5) mit gleichartigen pathologisch-anatomischen Veränderungen stammen aus Obduktionsmaterial.

Entsprechend den Kalyxveränderungen fanden sich im Nierenparenchym Narben, in welchen man auf grössere oder kleinere Gebiete mit mikroskopischen Bildern stiess, die an Thyreoideagewebe erinnerten. Dasselbe Gewebe fand Verf. ausserdem in einer Schrumpfniere, die durch eine Thrombose in der A. renalis bedingt war. Verf. hält es für wahrscheinlich, dass ein langsam vorsichgehender Untergang von Nierenparenchym eine wesentliche Bedingung für die Entstehung des thyreoideaähnlichen Gewebes bildet.

Während die Kalyxerweiterung in einem Falle als eine prästenotische Dilatation entstanden sein mag, hatten die Erweiterungen in zwei anderen Fällen eine solche Form, dass man einen Schrumpfungsprozess im Parenchym der Umgebung oder eine Missbildung annehmen muss.

## SUMMARY

The author describes four cases of dilatation of isolated renal calyces. The two first are particularly interesting as regards the roentgenologic diagnosis from nephrotuberculosis. In the first, there was found, in the inferior end of the kidney, a cavity which connected with the renal pelvis through a constricted calyx; and this cavity contained a mass, probably composed of calcified blood clots.

Cases 3 and 4, which show patho-anatomical changes of a similar nature, are from post-mortem material. In these, there were found, corresponding to the calycine changes, cicatrices in the renal parenchyma, and, within the latter, areas of varying size presenting a microscopical picture reminding of thyreoid tissue. Similar tissue has been found by the author in a kidney in which sclerosis had set in owing to thrombosis in the renal artery. He holds it for probable that a slowly progressive destruction of the renal parenchyma is an essential condition for the development of tissue of this thyreoidal character.

While in one of the cases the dilatation of the calyx may have occurred as a prestenotic enlargement, it was, in two of the other cases, of a form which made one conclude that it must be due either to a shrinking process in the surrounding parenchyma, or else to malformation.

## RÉSUMÉ

L'auteur relate 2 cas (1 et 2) de dilatation isolée d'un calice dont l'intérêt réside surtout dans le diagnostic différentiel radiologique avec la tuberculose rénale.

Dans le premier cas, on trouva au niveau du pôle inférieur d'un rein néphrectomisé une cavité, en communication avec le bassinet par un calice sténosé. Cette cavité renfermais une masse probablement constituée par des caillots de sang calcifiés.

Deux autres cas (4 et 5), présentant des lésions anatomo-pathologiques analogues, proviennent d'autopsies.

Correspondant aux lésions du calice, on voyait des lésions cicatricielles dans le parenchyme rénal; au sein de ces lésions, on notait des zones plus ou moins étendues donnant des images microscopiques rappelant le tissu thyroïdien. L'auteur a constaté un tissu analogue dans un cas de rein atrophique déterminé par une thrombose de l'artère rénale. L'auteur estime vraisemblable qu'une dégénérescence lente du parenchyme rénal est une des conditions essentielles de cette production de tissu pseudo-thyroïdien.

Tandis que, dans un des cas, la dilatation du calice peut s'être produite sous forme de dilatation pré-sténosique, l'extasie que l'on constatait dans deux autres cas avait une forme telle qu'on est contraint d'admettre l'existence d'un processus atrophique dans le parenchyme environnant ou d'une malformation.


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FROM THE ROENTGEN DEPARTMENT, AKADEMISKA SJUKHUSET, UPSALA (HEAD: PROF. HUGO LAURELL). FROM THE SURGICAL DEPARTMENT, AKADEMISKA SJUKHUSET, UPSALA (HEAD: PROF. GUNNAR NYSTRÖM).

# ON METEORISM IN PYELOGRAPHY[1]

by

*Bengt Lilja* and *Herman Wahren*

It is a common experience in roentgen examination of the abdomen to find extremely varying amounts of gas in the digestive tract. Roentgenological handbooks advise various methods for eliminating the gas when it obscures organs and tissues to be examined, especially in urological examinations. A number of different procedures have been suggested, such as different laxations, animal charcoal per os and by enema, atropin, cardiac stimulation, keeping the patient up and about etc. The multitude of methods in use and the varying procedures adopted in different places may be regarded as the outcome of our great uncertainty concerning these matters. In SCHINZ' Handbook (edition 1932) we find the following passage with regard to intestinal gas: »Leider lassen sich diese trotz aller Bemühungen bisher nicht beseitigen. Auch mit den angegebenen Medikamenten (Tierkohle, Bolus, Enzypan) haben wir in exakten Versuchen keine wesentliche Beeinflussung der Gasbildung im Dickdarm gesehen. Man gewinnt oft den Eindruck, dass nach zu intensiver Darmentleerung die Gasbildung stärker wird als ohne dieselbe.» Other authors also openly acknowledge these difficulties and refrain from trying to eliminate the gas. Further on in the same Handbook we read in the chapter on meteorism: »Die Ursache solcher hochgradiger Blähungszustände lässt sich nicht immer klären. Es ist zweifelhaft ob es sich um eine besonders starke Gasentwicklung (evtl. auf Basis von Dyspepsie und sonstigen Gärungszuständen) oder aber um temporäre Darmverschlüsse handelt. Dieselben könnten durch Abknickung oder durch lokale Krampfzustände bedingt sein.» It is obvious that very little information concerning the origin of this meteorism and the biological laws regulating the amount of intestinal gas is to be found in roentgenological literature.

[1] Submitted for publication Nov. 7th, 1933.

Several Swedish authors, LAURELL, MAGNUSSON and WAHREN, have studied these problems from different points of view, and it may be of interest to give a short summary of our present knowledge of these intricate problems, so difficult from the point of view of examination.

In retrograde pyelography the amount of intestinal gas often attains considerable volume. With the exception of MAGNUSSON's paper, there seem to exist no investigations concerning the connection between meteorism and pyelography. By means of comparing roentgen photographs taken shortly before the introduction of the cystoscope with photographs taken shortly afterwards, this author has verified the common roentgen experience that in this way gas may rapidly accumulate in the digestive canal.

What is then the cause of this peculiar meteorism which so often appears in connection with pyelography? The problem is of considerable medical interest and is well worth a careful investigation.

The most suitable method to study this process is, without doubt, to examine the production and the absorption of the intestinal gas separately, proceeding from the normal gaseous exchange. In this way we may form an opinion of the laws governing these processes and may be able to determine in which way cystoscopy and ureteral catherization influence the normal course of the gaseous exchange.

Under normal conditions the intestinal gas consists of $CO_2$, N, H, $CH_4$, $H_2S$, small quantities of methylmercaptan and traces of $O_2$.

These gases are derived partly from air swallowed together with the food, partly from chemical fermentative or bacteriological digestive processes. In addition to this exogenous gas production, an endogenous supply of gas may occur, when $CO_2$ from blood and surrounding tissues diffuses into the intestine.

It is a well-known fact that under normal conditions the $CO_2$-tension in the intestine is higher than that of the venous blood and surrounding tissues. Consequently this gas is given off from the intestine to the surrounding tissues. A change in this order of diffusion may, however, appear in connection with severe circulatory disturbances in the splanchnic area, in that the intracellular $CO_2$ is not then eliminated but retained in the tissues and the venous blood, their $CO_2$-tension thus becoming higher than that of the intestine. On account of the great solubility of $CO_2$ in water, the gas then rapidly diffuses over to the intestine.

Investigations regarding these matters have been carried out by MCIVER, BENEDICT and MONROE and also by BOJCOTT. The »endogenous $CO_2$-production» shown by these authors can under certain circumstances assume a considerable volume.

If we now turn to the question of the elimination of intestinal gas from the intestine, attention must first be called to the fact that the

primitive view that all intestinal gas escapes per vias naturales was disproved by ZUNTZ and TACKE already in the nineteenth century. Only a small fraction of the intestinal gas escapes this way, the greater part being absorbed by the blood and given off by the lungs. The understanding of this method of the organism to free itself from the accumulated intestinal gas is of fundamental importance for a true comprehension of the origin of meteorism. From the above we conclude — and full unity of opinion is prevailing in the literature on the subject — that *the circulatory conditions in the splanchnic area are of the utmost importance for the elimination of the accumulated intestinal gas.* Other influences also worth considering in this connection are the tonus of the gut, the partial tension of different gases in the intestine and the blood, the condition and extent of the absorbing mucous membrane. These conditions are, however, of secondary importance and are not liable to vary to the same extent as the circulatory conditions in the splanchnic area. From CAMPBELL's statement that the $CO_2$-tension in the subcutaneous tissue in experimental shock on cat rises from 46 to 108 mm. Hg it may be gathered how important the circulatory condition is for the gaseous exchange in the tissues.

Having thus summarily surveyed the conditions of production and absorption of intestinal gas, we may ask: Is it generally the conditions of production or the conditions of absorption that change in meteorism?

A detailed study of these problems is to be found in the early literature on the subject by ENDERLEN and HOTZ, in more recent literature by SCHOEN and others. The intestinal gaseous exchange in so-called paralytical ileus has been studied by WAHREN. The results of these investigations all tend to show that it is chiefly the absorption of the intestinal gas which is retarded in the meteoristic state.

Can then roentgenological experience of meteorism in man be brought into harmony with this experimentally gained knowledge? LAURELL has already in 1926 and later (in 1930) more completely published papers in which he emphasizes the great value of a normal circulation to the physiological regulation of the gaseous contents of the intestine. He groups together various cases with meteorism which all have this in common that a disturbance of the circulation, generalized or confined to the whole or part of the splanchnic area, is at hand. Such cases, according to LAURELL, are general cardiac insufficiency, toxic conditions in pneumonia, typhus etc., collapse and shock. Meteroism also occurs in cases of local circulatory disturbances in the splanchnic area, such as volvulus, thrombosis of the abdominal veins etc. Meteorism is also a prominent symptom in peritonitis, as well as in so-called postoperative ileus. Circulatory insufficiency is a conspicuous symptom in both of these conditions.

Meteorism may also be found in cases with traumatic affections of the abdomen, where the abdomen has sustained an injury without the peritoneal cavity being opened. LEICHTENSTERN has already in 1875 described such cases, as well as NOTHNAGEL who points out that: »Ein schweres stumpfes Trauma des Abdomen» may give rise to symptoms of ileus. In 1907 HEINECKE published a detailed account of these conditions, and in the literature of later years we find a great number of cases published. It seems very probable that the origin of the meteorism in these cases is a circulatory insufficiency brought about by the trauma.

Returning to our subject, meteorism in pyelography, we may ask ourselves: To which degree can the trauma caused by cystoscopy and pyelography influence the conditions of production and absorption of the intestinal gas?

Considering the production of intestinal gas, we find that a previous investigator, MAGNUSSON, has come to the conclusion that meteorism in pyelography can be explained by an increased amount of swallowed air. MAGNUSSON had undoubtedly shown us that a considerable, and in roentgen photography visible meteorism *can* arise from experimental swallowing of air. However, there is no proof of, nor any probability of such swallowing of air being the decisive factor for the production of meteorism in pyelography. It is conceivably possible that the swallowing of small amounts of air can take place when the recumbent patient, as is sometimes done, is made to drink water in order to obtain samples of urine. But merely on account of this it is hardly logical to surmise that the meteorism generally occurring in pyelography is due to this cause. The experiments carried out by BICKEL in 1906 and MCIVER and co-workers in 1926 concerning the influence of swallowed air in certain pathological conditions are not convincing on account of their incompleteness.

The gas production resulting from bacteriological digestive processes is of course not affected by cystoscopy.

Is there any reason to assume that the urological examination brings about any changes in the endogenous gas production or absorption? In accordance with the above, we find that this depends on the question if the trauma in pyelography is sufficiently powerful to cause a circulatory disturbance. Taking into consideration the strong reaction sometimes observed in patients who have recently undergone cystoscopy and ureteral catheterization, asserting itself with all the symptoms of a serious circulatory disturbance, such as pallor, cold sweat, nausea etc., it is hardly possible to doubt that the mere insertion of the instruments may under certain conditions cause a serious circulatory disturbance.

Clinical experience also tends to show that traumata of different kinds to the urogenital organs exceedingly often cause meteorism. In

the literature we find an immense number of reports concerning cases of ileus in connection with renal diseases, especially on the passing of stones through the ureter or after kidney operations. An extensive survey of these cases has been published by CLAVEL in 1927.

There is also some evidence proving that a trauma to the kidneys causes serious disturbance in the gas absorption of the intestine. WAHREN shows a diminution of the absorption of $CO_2$ in his above-mentioned work. In one animal the diminution amounted to 50 % after manipulating one of the kidneys for 15 minutes.

We may then conclude that a very great likeness exists between meteorism in pyelography and meteorism after a trauma to the abdomen or in connection with renal affections or after operations on the kidneys. In these latter cases it is reasonable to suppose that a disturbance of the circulatory conditions in the splanchnic area is the origin of the meteorism. It is therefore very likely that the same process causes meteorism in pyelography.

In order to reduce the meteorism which renders the interpretation of the radiograms more difficult and similarly the circulatory disturbances inconveniencing the patients, it is important trying to minimize, as far as possible, the trauma occasioned by the insertion of the instruments. Especially does this apply in cases where circulatory disturbances already exist, such as cardiovascular diseases, certain painful renal diseases etc.

At Upsala Akademiska Sjukhus cystoscopy and ureteral catheterization (in men) is now carried out under sacral anaesthesia and a special technique is used for the introduction of opaque substance into the renal pelvis. In most hospitals in Sweden the opaque matter is injected with a syringe under considerable superpressure. Since the renal pelvis at the time of injection is no doubt partly filled with urine, the relatively sudden dilatation taking place may cause considerable traumatism to which the patient also then reacts with pain. At the Upsala clinic, on the other hand, the often recommended method of pouring in the opaque substance with only a small and graded excess pressure, according to the principle of communicating vessels, is since long in use. Injection, and in that case only slowly and carefully executed, is seldom used. The painsaving method now described may, however, also be of importance from the point of view of radiographic distinctness, at least in those cases where repeated injections are necessary, whereby the time of examination is prolonged and the meteorism has time for still further development. It is also striking to note that with the above-mentioned precautions the meteorism in most cases only reaches a comparatively small degree.

## SUMMARY

A short review of the general principles governing the gaseous exchange in the intestine. The most important and most varying factor is the circulation in the splanchnic area. Circulatory disturbances here cause a pathological accumulation of gas in the intestine. The necessary trauma to the organism in pyelography may well be regarded as the cause of such a circulatory disturbance. It is therefore essential to endeavour as far as possible to diminish the trauma at the examination.

## ZUSAMMENFASSUNG

Verf. berichten kurz über die allgemeinen Regeln, nach welchen der Gasaustausch im Darm vorsichgeht. Der wichtigste und variierendste Faktor ist die Zirkulation im Splanchnikusgebiet. Zirkulationsstörungen rufen hier eine pathologische Ansammlung von Gas im Darm hervor. Das unvermeidliche Trauma, das der Organismus bei Pyelographie erleidet, dürfte wohl als Ursache einer solchen Zirkulationsstörung zu betrachten sein. Es ist deshalb von wesentlicher Bedeutung zu versuchen, das Trauma bei der Untersuchung möglichst zu verringern.

## RÉSUMÉ

Brève revue des principes présidant aux échanges gazeux dans l'intestin. Le facteur le plus important et le plus variable est la circulation dans la surface splanchnique. Les troubles circulatoires causent ici une accumulation de gaz dans l'intestin. Le traumatisme de l'organisme produit par la pyélographie peut très bien être considéré comme cause d'un trouble circulatoire de cette nature. Aussi importe-t-il de chercher, dans la mesure du possible, à atténuer ce traumatisme au cours de l'examen.

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FROM THE SURGICAL DEP'T OF THE AARHUS MUNICIPAL HOSPITAL (CHIEF: H. STRANDGAARD, M. D.) AND THE RADIUM CENTRE FOR JYLLAND (CHIEF: CARL KREBS, M. D.)

# RESULTS OF THE TREATMENT OF UTERINE CANCER AT THE AARHUS RADIUM CENTRE (DENMARK)[1]

by

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The present report, which includes cases of uterine and vaginal cancer treated at the Radium Centre in Aarhus during the period between 1st January, 1914, and 31st December, 1931. A detailed statistical analysis has been made only of the cases from the period 1914—27. As our own figures for certain groups are so small that the resulting percentages might convey an erroneous impression, I have strengthened them by making use of the much larger material of the Munich statistics for 1913—23 as a means of comparison, by adding the figures from the latter, in parenthesis, after our own, in all the tables and calculations.

In compiling this survey of the results obtained in the Aarhus institution, I have tried to comply with the requirements laid down in 1922, by WINTHER, for reliable statistical presentation.

*January 1914—December 1931 (1912—1928)*

| | | |
|---|---|---|
| Cancer of the uterine cervix | 653 | (2226) |
| » » » body of the uterus | 63 | (167) |
| » » » vagina | 17 | (160) |

*January 1914—December 1927 (1913—1923)*

| | | |
|---|---|---|
| Cancer of the uterine cervix | 334 | (1448) |
| » » » body of the uterus | 16 | (94) |
| » » » vagina | 8 | (89) |

Of the 1448 cases in the Munich material, only 1319 are included in the calculations, as 129 were either moribund, hopeless or refused to be treated. Of those in the Aarhus material, 5 did not receive any treatment, but otherwise we have treated all cases, even the absolutely hopeless ones.

[1] Submitted for publication Dec. 2nd, 1933,

*Cancer of the Uterine Cervix, Aarhus 1914—1931 (1913—1923) divided according to Stage of Disease*[1]

| | | |
|---|---|---|
| Stage I | 139 — 21.2 per Cent | (227 — 17.2 per Cent) |
| » II | 121 — 18.5 » » | (310 — 23.6 » » ) |
| » III | 221 — 33.7 » » | (543 — 41.2 » » ) |
| » IV | 172 — 26.3 » » | (239 — 18.0 » » ) |

## Cancer of the Uterine Cervix, Stage I

Number of cases treated, 44 (227). Number of cases cured, 15 (92). Relative cure rate, 15 : 44 = 34.2 per Cent (40.5 per Cent).

**Stage I. Division by Treatment applied**

| Treatment | No. cases | No. cured | per Cent |
|---|---|---|---|
| Radium | 8 (94) | 4 (37) | 50 (39.5) |
| Combined treatment | 35 (130) | 11 (54) | 31.5 (41.5) |
| Roentgen | 1 (3) | 0 (1) | |
| | **44 (227)** | **15 (92)** | **34.2 (40.5)** |

**Stage I. Age Incidence of Cases treated and cured**

| Age | 20—25 | 26—30 | 31—35 | 36—40 | 41—45 | 46—50 | 51—55 | 56—60 | 61—65 | 66—70 | 71—75 | 76—80 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treated | 0 (1) | 4 (4) | 5 (16) | 6 (25) | 4 (45) | 7 (35) | 5 (38) | 5 (39) | 6 (16) | 1 (7) | 1 (1) | 0 (1) | 44 (227) |
| Cured | 0 (1) | 2 (1) | 2 (4) | 1 (12) | 1 (22) | 4 (11) | 0 (15) | 2 (14) | 3 (8) | 0 (4) | 0 (0) | 0 (0) | 15 (92) |
| Ratio | 9 : 4 (21 : 16) | | | 10 : 2 (70 : 34) | | 12 : 4 (73 : 26) | | 13 : 5 (63 : 26) | | | | | 44 : 15 (227 : 92) |
| Per Cent | 44.5 (28.5) | | | 20 (48.5) | | 33.3 (35.6) | | 38.4 (41.2) | | | | | 34.2 (40.5) |

**Stage I. Duration of Life in 44 (227) Cases**

| Alive less than | Number | Died from cancer | Died from intercurrent disease | Alive after | Number |
|---|---|---|---|---|---|
| 1 year | 6 (40) | 6 (38) | 0 (2) | 1 year | 38 — 86.3 per Cent (187 — 82.3 per Cent) |
| 2 years | 15 (55) | 15 (53) | 0 (2) | 2 years | 23 — 58.9 » » (132 — 58.1 » » ) |
| 3 » | 2 (28) | 2 (27) | 0 (1) | 3 » | 21 — 47.7 » » (104 — 45.8 » » ) |
| 4 » | 4 (7) | 4 (7) | 0 (0) | 4 » | 17 — 38.7 » » (97 — 42.7 » » ) |
| 5 » | 2 (5) | 2 (3) | 0 (2) | 5 » | 15 — 34.2 » » (92 — 40.5 » » ) |

The table shows that from the third to the fifth year the result varies only slightly.

[1] The division is made according to the rules laid down by the Commission on Radiology of the Society of Nations.

A comparison between the proportion of cures obtained among patients of the middle and working classes respectively may serve to show the importance of careful and sufficient after-treatment. The figures are as follows:

*Middle-class patients*, 11 (32); cured, 7 (15); relative cure rate, 63.6 (46.8) per Cent.

*Working class patients*, 33 (159); cured, 8 (77); relative cure rate, 24.2 (39.4) per Cent.

The average persistence of symptoms, for cases in the 1st stage, was 6.8 months; maximum, 30 months; minimum, 3 days.

The average parity incidence, for 139 patients, was 4.6; 22 patients were nulliparae.

The average age of the 139 patients was 47.5 years; the youngest was 25, the oldest 84 years old.

Of the 139 patients, 98 belonged to the working class, 41 to the middle class; 49 were from the rural districts, 90 from the towns.

Microscopically, the 139 cases were apportioned as follows: Solid carcinoma, 118; pavement-cell carcinoma, 6; adenocarcinoma, 6; incipient cancer, 6; no microscopy, 3.

Two patients of Group I cannot be traced, and are therefore counted as dead.

### Cancer of the Uterine Cervix, Stage II

Number of cases treated, 56 (310). Number of cases cured, 18 (69). Relative cure rate, 18 : 56 = 32.2 per Cent (22.3 per Cent).

**Stage II. Division by Treatment applied**

| Treatment | No. cases | No. cured | Total |
|---|---|---|---|
| Radium | 8 (129) | 3 (27) | 37.5 (20.9) |
| Combined treatment | 48 (170) | 15 (40) | 31.3 (23.5) |
| Roentgen | 0 (11) | 0 (2) | |
| | **56 (310)** | **18 (69)** | **32.2 (22.3)** |

Of the cases in the Munich material, the treatment was carried through completely in 251; of which, as the table shows, 69 were cured, giving a relative cure rate of 69 : 251 = 28.3 per Cent. Of the cases in which the treatment was not carried through to the end, none are alive after 5 years.

**Stage II. Age Incidence of Cases treated and cured**

| Age | 20—25 | 26—30 | 31—35 | 36—40 | 41—45 | 46—50 | 51—55 | 56—60 | 61—65 | 66—70 | 71—75 | 76—80 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treated | 1 (0) | 5 (6) | 4 (14) | 5 (44) | 7 (50) | 8 (68) | 12 (64) | 4 (37) | 5 (22) | 3 (2) | 2 (1) | 0 (0) | 56 (310) |
| Cured | 0 (0) | 1 (0) | 1 (3) | 1 (8) | 4 (9) | 3 (23) | 5 (11) | 1 (6) | 2 (8) | 0 (1) | 0 (0) | 0 (0) | 18 (69) |
| Ratio | 10 : 2 (22 : 3) | | | 20 : 8 (162 : 40) | | | 26 : 8 (126 : 26) | | | | | | 56 : 18 (310 : 69) |
| Per Cent | 20 (13.6) | | | 40 (24.7) | | | 32.5 (20.6) | | | | | | 32.2 (22.3) |

**Stage II. Duration of Life in 56 (310) Cases**

| Alive less than | Number | Died from cancer | Died from inter-current disease | Alive after | Number |
|---|---|---|---|---|---|
| 1 year | 10 (107) | 10 (105) | 0 (2) | 1 year | 40 — 82.1 per Cent (203 — 65.5 per Cent) |
| 2 years | 17 (81) | 17 (81) | 0 (3) | 2 years | 29 — 51.8 » » (119 — 36.4 » » ) |
| 3 » | 3 (34) | 3 (32) | 0 (2) | 3 » | 26 — 46.4 » » (85 — 27.7 » » ) |
| 4 » | 3 (14) | 3 (13) | 0 (1) | 4 » | 23 — 41.1 » » (71 — 22.9 » » ) |
| 5 » | 5 (2) | 5 (2) | 0 (0) | 5 » | 18 — 32.2 » » (69 — 22.3 » » ) |

Proportion of cures among middle and working class patients respectively, in the 2nd stage:

*Middle class*, treated, 15 (29); cured, 5 (9); relative cure rate, 33.3 (31) per Cent.

*Working class*, treated, 41 (281); cured, 13 (60); relative cure rate, 31.7 (21.3) per Cent.

Duration of symptoms, for cases in 2nd stage: average, 6.5 months; maximum, 30 months; minimum, 14 days.

Average parity incidence, for 121 patients, 4.6; 19 patients were nulliparae.

Average age of the 121 patients, 44.6 years; youngest 23, oldest 73 years old.

Number of working class patients; 83; middle class patients, 38. Number from rural districts, 48; from towns, 73.

Microscopy: Solid carcinoma, 98; pavement-cell carcinoma, 4; adenocarcinoma, 7. No microscopy, 12.

Three patients belonging to Group II cannot be traced, and are therefore counted as dead.

## Cancer of the Uterine Cervix, Stage III

Number of cases treated, 121 (543). Number of cases cured, 17 (58). Relative cure rate, 17 : 121 = 14 (10.7) per Cent.

**Stage III. Division by Treatment applied**

| Treatment | No. cases | No. cured | Total |
|---|---|---|---|
| Radium | 22 (281) | 2 (25) | 9.1 (8.5) |
| Combined treatment | 98 (236) | 15 (31) | 15.3 (13.1) |
| Roentgen | 0 (26) | 0 (2) | |
| | **120 (543)** | **17 (58)** | **14.1 (10.7)** |

1 patient refused radiation treatment.

**Stage III. Age Incidence of Cases treated and cured**

| Age | 20—25 | 26—30 | 31—35 | 36—40 | 41—45 | 46—50 | 51—55 | 56—60 | 61—65 | 66—70 | 71—75 | 75—80 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treated | 0 (0) | 3 (6) | 11 (34) | 13 (34) | 26 (62) | 25 (106) | 15 (99) | 10 (85) | 9 (39) | 6 (19) | 1 (2) | 2 (2) | 121 (543) |
| Cured | 0 (0) | 1 (0) | 1 (1) | 0 (5) | 5 (6) | 3 (14) | 1 (11) | 3 (14) | 2 (5) | 1 (1) | 0 (1) | 0 (0) | 17 (58) |
| Ratio | 14 : 2 (40 : 1) | | | 79.9 (356 : 36) | | | | 28.6 (147 : 21) | | | | | 121 : 17 (543 : 58) |
| Per Cent | 14.3 | | | 11.4 (10.1) | | | | 21.4 (14.1) | | | | | 14 (10.7) |

**Stage III. Duration of Life in 121 (543) Cases**

| Alive less than | Number | Died from cancer | Died from intercurrent disease | Alive after | Number |
|---|---|---|---|---|---|
| 1 year | 18 (291) | 18 (291) | 0 (0) | 1 year | 103 — 85.3 per Cent (252 — 46.4 per Cent) |
| 2 years | 61 (137) | 61 (134) | 0 (3) | 2 years | 42 — 34.7 » » (115 — 21.1 » » ) |
| 3 » | 18 (42) | 18 (41) | 0 (1) | 3 » | 24 — 19.8 » » (73 — 13.4 » » ) |
| 4 » | 6 (11) | 6 (11) | 0 (0) | 4 » | 18 — 14.9 » » (62 — 11.4 » » ) |
| 5 » | 1 (4) | 1 (4) | 0 (0) | 5 » | 17 — 14.0 » » (58 — 10.7 » » ) |

Proportion of cures among middle and working class patients respectively:

*Middle class*, treated, 35 (35); cured, 8 (10); relative cure rate, 22.9 (28.5) per Cent.

*Working class*, treated, 86 (508); cured, 9 (48); relative cure rate, 10.5 (9) per Cent.

Duration of symptoms, for patients in 3rd stage: average, 7.3 months; maximum, 48 months; minimum, 14 days.

Average parity incidence, for 221 patients, 4.4; 24 patients were nulliparae.

Average age of the 221 patients, 48 years; youngest 27, oldest 79 years old.

161 of the patients belonged to the working classes, 60 to the middle classes; 68 were from the rural districts, 153 from the towns.

Microscopy: Solid carcinoma, 183; pavement-cell carcinoma, 16; adenocarcinoma, 9. No microscopy, 13.

1 patient, from 1920, refused to be treated. Died in 1921.

2 patients — one from 1921, the other from 1931 — are alive, with no sign of cancer; but one of them with a vesicovaginal, the other with a rectovaginal fistula.

## Cancer of the Uterine Cervix, Stage IV

Number of cases treated, 113 (239). Number of cases cured, 6 (3). Relative cure rate, 6 : 113 = 5.4 (1.3) per Cent.

**Stage IV. Division by Treatment applied**

| Treatment | No. cases | No. cured |
|---|---|---|
| Radium | 31 | 1 |
| Combined treatment | 73 | 5 |
| Roentgen | 5 | 0 |
| | 109 | 6 |

The condition of 4 patients was so bad that radiation treatment was not attempted.

**Stage IV. Age Incidence of Cases treated and cured**

| Age | 20—25 | 26—30 | 31—35 | 36—40 | 41—45 | 46—50 | 51—55 | 56—60 | 61—65 | 66—70 | 71—75 | 75—80 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treated | 2 | 5 | 9 | 10 | 12 | 24 | 18 | 15 | 8 | 3 | 2 | 5 | 113 |
| Cured | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 6 |
| Ratio | | | | | | | | | | | | | 113:6 |
| Per Cent | | | | | | | | | | | | | 5.4 |

**Stage IV. Duration of Life in 113 (239) Cases**

| Alive less than | Number | Died from cancer | Died from intercurrent diseases | Alive after | Number |
|---|---|---|---|---|---|
| 1 year . . . | 47 (181) | 47 (181) | 0 (0) | 1 year | 66 — 59.1 per Cent (58 — 24.2 per Cent) |
| 2 years . . . | 45 (44) | 45 (44) | 0 (0) | 2 years | 21 — 18.8 » » (14 — 5.8 » » ) |
| 3 » . . . | 9 (9) | 9 (9) | 0 (0) | 3 » | 12 — 10.8 » » (5 — 2.1 » » ) |
| 4 » . . . | 2 (1) | 2 (1) | 0 (0) | 4 » | 10 — 9.0 » » (4 — 1.7 » » ) |
| 5 » . . . | 4 (1) | 4 (1) | 0 (0) | 5 » | 6 — 5.4 » » (3 — 1.3 » » ) |

Duration of symptoms, for patients in the 4th stage: average, 10 months; maximum, 72 months; minimum, 2 days.

Average parity incidence, for the 172 patients, 4; 29 patients were nulliparae.

Average age, 50 years; youngest 24, oldest 77 years old.

140 of the patients belonged to the working classes, 32 to the middle classes; 50 were from the rural districts, 122 from the towns.

Microscopy: Solid carcinoma, 126; pavement-cell carcinoma, 12; adenocarcinoma, 4. No microscopy, 30.

1 patient can not be traced, and is therefore counted as dead.

2 patients died while their treatment was yet in course; 2 subsequently developed rectovaginal fistula.

## Results in all the Cases of Cancer of the Uterine Cervix treated by Radiation

Number of cases treated, 334 (1319). Alive and well after five years, 56 (222). Absolute cure rate, 56 : 334 = 16.8 (15.4) per Cent.

In the Munich material, the 103 cases in which the treatment was not carried through are deducted; after which the absolute cure rate for that material is 222 : 1216 = 18.2 per Cent.

Of the cases in the Aarhus material, 1 in stage III and 4 in stage IV were not treated. Absolute cure rate, 56 : 329 = 17 per Cent.

**Cases of Cancer of the Uterine Cervix, of all Stages, divided according to Treatment applied**

| | Number | Cured | Percentage |
|---|---|---|---|
| Radium . . . . . | 69 (648) | 10 (91) | 14.5 (14.0) |
| Combined treatment . . . . . | 254 (589) | 46 (126) | 18.1 (21.4) |
| Roentgen . . . . . | 6 (82) | 0 (5) | |
| | **329 (1319)** | **56 (222)** | **17.0 (15.4)** |

By the showing of the Munich figures and — in a lesser degree — by our own, it is thus the combined treatment by radium and roentgen which gives the best results.

**Age Incidence for all the Cases of Cancer of the Uterine Cervix, treated and cured**

| Age | 20—25 | 26—30 | 31—35 | 36—40 | 41—45 | 46—50 | 51—55 | 56—60 | 61—65 | 66—70 | 71—75 | 76—80 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treated | 3 (2) | 17 (18) | 29 (72) | 34 (158) | 49 (223) | 64 (254) | 50 (246) | 34 (202) | 28 (92) | 13 (45) | 6 (4) | 7 (3) | 334 (1319) |
| Cured | 0 (1) | 4 (1) | 4 (8) | 3 (26) | 10 (38) | 12 (48) | 7 (37) | 6 (35) | 8 (21) | 2 (6) | 0 (1) | 0 (0) | 56 (222) |
| Ratio | 49 : 8 (92 : 10) | | | 197 : 32 (635 : 112) | | | | 88 : 16 (592 : 100) | | | | | 334 : 56 (1319 : 222) |
| Per Cent | 16.3 (10.9) | | | 16.2 (17.6) | | | | 18.2 (16.9) | | | | | 16.8 (15.4) |

The Munich figures show that the rate of cure does not reach its maximum until after the thirty-fifth year of age.

**Duration of Life for all the 334 (1319) Cases of Cancer of the Uterine Cervix**

| Alive less than | Number | Died from cancer | Died from intercurrent diseases | Alive after | Number |
|---|---|---|---|---|---|
| 1 year | 81 (619) | 81 (615) | 0 (4) | 1 year | 263 — 78.8 per Cent (700 — 53.0 per Cent) |
| 2 years | 138 (320) | 138 (312) | 0 (8) | 2 years | 115 — 34.4 » » (380 — 28.8 » » ) |
| 3 » | 32 (113) | 32 (109) | 0 (4) | 3 » | 83 — 24.8 » » (267 — 20.2 » » ) |
| 4 » | 15 (33) | 15 (32) | 0 (1) | 4 » | 68 — 20.4 » » (234 — 17.7 » » ) |
| 5 » | 12 (12) | 12 (10) | 0 (2) | 5 » | 56 — 16.8 » » (222 — 15.4 » » ) |

Proportion of cures among middle and working class patients respectively, for the entire material:

*Middle class*, treated, 81 (104); cured, 21 (34); relative cure rate, 25.9 (32.6) per Cent.

*Working class*, treated, 253 (1215); cured, 35 (188); relative cure rate, 13.8 (14.6) per Cent.

## Cancer of the Body of the Uterus

The Munich material contains 94 cases with five years' observation time. From this number are deducted 6 cases, 3 of which were operated on, and the other 3 hopeless.

During the years 1913—1923, 88 cases were treated by radiation. Of these, 36 were alive after five years. Absolute rate of cure by radiation treatment, 36 : 88 = 40.9 Per Cent.

The statistical arrangement of the Munich material is the same with regard to these cases as with regard to the cases of cancer of the uterine cervix.

**Cases of Corporeal Cancer. Division by Treatment applied**

| Treatment | Number | Cured | Percentage |
|---|---|---|---|
| Radium . . . . . | 43 | 12 | 27.9 |
| Combined treatment . . . . | 42 | 23 | 54.7 |
| Roentgen . . . . . | 3 | 1 | |
| | 88 | 36 | 40.9 |

Also these figures show the outstanding value of the combined treatment.

**Age Incidence of Corporeal Cancer Cases treated and cured**

| Age | 20—25 | 26—30 | 31—35 | 36—40 | 41—45 | 46—50 | 51—55 | 56—60 | 61—65 | 66—70 | 71—75 | 76—80 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treated . . . | 0 | 0 | 1 | 2 | 9 | 14 | 15 | 25 | 8 | 10 | 3 | 1 | 88 |
| Cured . . . . | 0 | 0 | 0 | 0 | 7 | 7 | 7 | 8 | 2 | 3 | 2 | 0 | 36 |
| Ratio . . . . | 3 : 0 | | | | 38 : 21 | | | 47 : 10 | | | | | 88 : 36 |
| Per Cent . . | | | | | 55.2 | | | 31.9 | | | | | 40.9 |

**Duration of Life in 88 Cases of Corporeal Cancer**

| Alive less than | Number | Died from cancer | Died from intercurrent diseases | Alive after | Number |
|---|---|---|---|---|---|
| 1 year . . . . . | 22 | 22 | 0 | 1 year | 66 |
| 2 years . . . . . | 16 | 13 | 3 | 2 years | 50 |
| 3 » . . . . . | 9 | 8 | 1 | 3 » | 41 |
| 4 » . . . . . | 4 | 4 | 0 | 4 » | 37 |
| 5 » . . . . . | 1 | 0 | 1 | 5 » | 36 |

Of the 88 cases, 50 were operable, 38 positively inoperable. The operability is thus 56.8 per Cent. Of the 50 operable, 33 were alive and well after five years; the relative cure rate is thus 33 : 50 = 66.0 per Cent.

Of the positively inoperable, were alive and well after five years; giving a relative cure rate of 3 : 38 = 7.9 per Cent.

If we examine how the cases have developed according to the method of treatment employed, we find that

(a) of the 50 operable ones, 28 were treated by combined radium and roentgen therapy; the number of cured was 22; the relative rate of cure consequently 22 : 28 = 78.5 per Cent;

(b) of the same 50, 19 were treated exclusively by radioactive preparations; of these, 10 are alive after five years; the relative cure rate by this method consequently 10: 19 = 52.6 per Cent.

The cases of corporeal cancer from the Radium Centre in Aarhus are distributed as follows: Number of cases from January, 1914, to December, 1931, 63; number of cases from January, 1914, to December, 1927, 16. Of these 16, 5 are cured. Absolute cure rate by radiation therapy, 31.2 (40.9) per Cent.

The Aarhus material is so small that no valid estimate can be based on its figures. If we include in the calculations the cases from 1928 and 1929 — which is permissible because the largest number, by far, of the patients who die from the disease do so during the first two years after treatment (see the Munich figures) — we get an observation time of 3 years. The number of cases will then be 30, of which 13 are still alive. This gives, for an observation time of 3 years, an absolute cure rate of 13: 30 = 43.4 per Cent; which is nearly the same as that of the Munich statistics.

The average duration of the symptoms, for the 63 cases, was 12 months; maximum, 84 months; minimum, 14 days.

The average age of the 63 patients was 59.7 years; youngest, 34; oldest, 81 years old.

The average parity incidence for all 63 patients was 2.9. Fourteen were nulliparae.

Of the 63, 29 belonged to the working classes, 34 to the middle classes; 36 were from the rural districts, 27 from the towns.

Microscopy: Adenocarcinoma, 58; pavement-cell carcinoma, 2; solid carcinoma, 2. No microscopy, 1.

In the Aarhus material for the period 1914—1931 there are 36 cases of corporeal cancer treated by surgical methods. Of these, 31 were operated on prior to December 1927, and of these 31 patients 14 are still alive. The relative cure rate by operative methods is thus 14 : 31 = 45.2 per Cent.

The operative procedures were apportioned as follows: Wertheim's operation, 30 cases; Chroback's operation, 3 cases; hysterectomy, 2 cases; method not specified, 1.

There were 4 deaths in connexion with the operations. The primary morbidity rate was thus 11.1 per Cent.

The microscopy in the 36 cases was as follows: Adenocarcinoma, 27; pavement-cell carcinoma, 2; solid cancer, 1. No microscopy, 5.

One of the 36 patients can not be traced, and is therefore counted as dead.

Of cases operated on and postoperatively treated with irradiation, the Aarhus material for 1914—1931 contains 50. Of these, 44 were operated on and treated prior to December, 1927, and of these 44, 5 are alive after five years; which gives a relative cure rate of 5 : 44 = 11.4 per Cent.

The operative procedures in the 50 cases were apportioned as follows: Wertheim's operation, 46 cases; total vaginal hysterectomy, 4.

There were 8 deaths in connexion with these operations; which gives a primary morbidity rate of 16 per Cent.

The microscopy was as follows: Solid carcinoma, 26; pavement- cell carcinoma, 7; adenocarcinoma, 7. No microscopy, 10.

The Munich material contains some brief statistics with regard to radiation-treated recurrences following operation. The number of such cases, during the period 1913—1923, was 170. Of these, 17 were alive and well after five years, the cure rate, for radiation treatment under those circumstances, consequently 17: 170 = 10 per Cent.

For 115 of the 170, the diagnosis was verified by microscopical examination, and of these 115, 12 were alive after five years, which gives a cure rate, for positive cases, of 10.4 per Cent.

### Carcinoma of the Vagina

The Munich statistics for 1913—1923 contain 89 cases of this character. Four of the patients were still alive after five years, which gives a cure rate, for the radiation treatment, of 4 : 89 = 4.5 per Cent.

The Aarhus material for 1914—1931 contains 17 cases of vaginal carcinoma, of which 8 are prior to December, 1927. These 8 have all died.

Cases of cancer of the vulva are not included in the Aarhus statistics, and the figures from the Munich statistics in that respect are therefore omitted here.

If we compute the figures for all cases of cancer of the uterine cervix recorded in the literature, irrespective of the stage of the disease and the form of radiation treatment applied, we get a total of 5,246 cases, of which 913 were cured; or an average cure rate of 17.4 per Cent.

Of 1,093 operable and borderline cases, 444 are alive after five years. The relative cure rate for operable cases is thus 42.7 per Cent. The corresponding figure for inoperable and incurable cases is 11.1 per Cent.

Similarly we find for cancer of the body of the uterus a mean absolute cure rate, by radiation therapy, of 35.9 per Cent; a mean relative cure rate for the operable cases of 56.5 per Cent.

The statistics published in 1931, by CHIEWITZ, of cases of cervical cancer from the Radium Centre in Copenhagen during the period 1921—1927, represent a total of 532 cases. Of those, 5 are eliminated for special reasons, leaving a total of 527, apportioned as follows: Operable, 27; borderline, 29; inoperable I, 46; inoperable II, 84; inoperable III, 336.

Of the operable cases, 41 per Cent are alive, of the borderline cases 44 per Cent, both with an observation time of five years. Of both these groups together, 41 per Cent are alive after five years.

Of the inoperables, there are alive after five years 35 per Cent of group I, 34 per Cent of group II, 14 per Cent of group III; of the three groups together in all 51 patients, or 19 per Cent.

Of the entire material, 65 patients (22 per Cent) are alive after five years.

From the Aarhus Municipal Hospital and Radium Centre there have before this appeared two reports on the subject of uterine cancer. In the first of these, which was published in 1922, ERNST LASSEN accounted for 24 cases of Wertheim's operation during the years 1913—1920, among which were 2 cases of corporeal cancer, operated on respectively in 1913 and 1914. The two patients lived and were well. Of the other 22, 8 died in connexion with the operation, in 8 the cancer recurred, while 6 lived without recurrence. The shortest observation time was 2 years. The second publication, by DALSGAARD-NIELSEN, in 1924, gave what were probably the first statistics with regard to radiation treatment of uterine cancer in Denmark. His report comprises 164 cases, part of them treated by radiation, part of them by surgery. With regard to the former he gives the following figures:

Of 21 operable cases, 6 (29 per Cent) were alive and free from symptoms, of the inoperable ones, 12 per Cent. The shortest observation time for any of the cases had been one year.

Among the material were 26 cases of cervical cancer operated on. Of these, 27 per Cent were alive and free from symptoms with an observation time of at least five years. For comparison with the latter figure may be cited here the corresponding figures from an earlier work — CARL OTTO's thesis for the medical doctorate degree, 1900, — in which are reported 87 cases of cancer of the cervix from the Copenhagen Municipal Hospital, of which 28.1 per Cent were alive and free from symptoms after five years.

The method as far as possible uniformly employed at the Radium Centre in Aarhus, in the treatment of cancer of the uterine cervix, is as follows:

If the diagnosis is positive, and the patient's condition makes it possible to commence the treatment at once, radium in tube is, on the day after admission, inserted in the uterine cavity, and radium in capsule applied against the portio vaginalis. This treatment is repeated after 10 days. The precaution is taken to have abundant tamponage toward the rectum, in order to avoid the highly unpleasant rectal complications liable to follow treatment with radium. It must be added, however, that, in contrast to what was the case prior to 1927, complaints of such complications are now exceedingly rare. In all, 3000 mgr. hours are given in the uterus, and 4000 mgr. hours in the vagina. After 1 month's time, the patient comes back for roentgen treatment. In the course of this, 1000 r are given over each parametrium; filter, 1 mm. Al + 1 mm. Cu; 4 mm. ampère; 160 kilovolts. The dose is given in 5 seances. During the following year, the patient comes in for after-examination every second month, and afterwards at longer intervals; but as far as possible she is never lost sight of.

In conclusion, some words may be said about the importance of careful and sufficient after-treatment. In the Munich statistics it is seen, with regard to the results of the treatment, that there is a difference of about 20 per Cent between the proportion of cures effected on patients belonging respectively to the middle and the working classes. And this difference is found not only in the Munich statistics. WINTZ, for instance, has found something precisely similar; and our own statistics show a difference, in that respect, of about 10 per Cent; which probably corresponds fairly well with the figures from abroad, because we may undoubtedly take it for granted that the working class population in Denmark is, on the whole, better situated than in most other countries. There can hardly be any doubt but that this higher percentage of cures among patients of the middle class is due to their living under better conditions, — that they are better able to afford the necessary rest, better able to attend to matters of personal hygiene, better able to provide themselves with the abundant and nourishing food which is necessary if the general condition is to be built up and maintained as it ought to. There is no doubt but that the results, in the case of patients from the working classes, might become better if it were possible to keep them a longer time at the Radium Centre; but with the limited accommodations there such a thing is unfortunately out of the question. All that can be done is to instruct the patients carefully how they should best take care of themselves at home, and then hope that their economic situation may be such as to enable them to follow the given advice, especially in all that pertains to

the most scrupulous personal hygiene and plenty of rest. If any advance in the cure rate for cancer of the uterine cervix is to be expected in a not too distant future, the elimination of that 10 per Cent difference, representing the poorer results of the treatment in cases of patients of the working class, is undoubtedly the point toward which the effort should be directed first of all.

## SUMMARY

The author presents a statistical report of the cases of uterine and vaginal cancer treated at the Radium Centre in Aarhus (Denmark) during the period 1914—1931. His statistics are divided into two parts, the material with five years'observation time being analysed in detail according to the rules of Winther for work of this kind, while the more general statistical information takes in all of the cases from the period. For the sake of comparison, he gives in parenthesis, all through, the corresponding figures of a statistical report from Munich.

In Aarhus, the absolute cure rate for the four stages of cancer of the uterine cervix together is 17 per Cent (Copenhagen, 22 per Cent; Munich, 18.2 per Cent). For cancer of the body of the uterus, it seems as if the absolute cure rate is about the same as in the Munich clinic, namely about 40 per Cent.

In the second part, the author surveys some cases of cervical cancer treated respectively by radiation and surgery. It is seen that a cure is effected in about 10 per Cent of such cases.

Finally the author lays stress on the importance of careful and sufficient after-treatment in cases of this character, and illustrates this by pointing to the difference in the proportion of cures obtained among patients respectively of the middle and the working classes.

## ZUSAMMENFASSUNG

Verf. bringt einen statistischen Bericht über die Fälle von Uterus- und Vaginalkarzinom, die in der Radiumzentrale zu Aarhus (Dänemark) in der Periode 1914—1931 behandelt wurden. Seine Statistiken sind in zwei Teile geteilt: das Material mit 5-jähriger Beobachtungszeit, das nach den Wintherschen Regeln für Arbeiten dieser Art im Detail analysiert ist, während in dem mehr allgemeinen statistischen Bericht alle Fälle aus dieser Periode einbezogen sind. Zum Zwecke des Vergleichs sind durchwegs die entsprechenden Zahlen aus einem statistischen Bericht von München in Klammern angegeben.

In Aarhus beträgt die absolute Heilungsziffer für die vier Stadien von Zervixkarzinom zusammen 17 % (Kopenhagen 22 %; München 18.2 %).

Was die Zahlen für Karzinome des Corpus uteri betrifft, scheint die absolute Heilungsziffer ungefähr dieselbe zu sein wie in der Münchener Klinik, nämlich ungefähr 40 %.

Im zweiten Teil unterzieht Verf. einige Fälle von radiologisch resp. chirurgisch behandeltem Zervixkarzinom einer eingehenden Betrachtung, aus der hervorgeht, dass in ungefähr 10 % solcher Fälle Heilung erreicht wurden.

Schliesslich betont Verf. die Wichtigkeit sorgfältiger und ausreichender Nachbehandlung in Fällen dieser Art und illustriert dies durch einen Hinweis auf den Unterschied zwischen den bei Patientinnen der Mittel- und der Arbeiterklasse erreichten Heilungsprozentzahlen.

## RÉSUMÉ

L'auteur communique un relevé statistique des cas de cancers utérin et vaginal soignés au Centre de Radiumthérapie de Aarhus (Danemark) de 1914 à 1931. Cette statistique est divisée en deux groupes: le matériel ayant été l'objet d'une observation de 5 ans a été analysé en détail suivant les règles indiquées par WINTHER pour les travaux de cette nature, tandis que les éléments statistiques plus généraux comprennent la totalité des cas observés au cours de la période ci-dessus. Dans un but comparatif, l'auteur donne partout entre parenthèses les données correspondantes d'un exposé statistique de Münich.

La proportion de guérison absolue pour les quatre stades du cancer du col réunis est de 17 % (Copenhague, 22 %; Münich, 18.2 %).

En ce qui concerne les données du cancer du corps, il semble que la proportion de guérison absolue soit à peu près la même que celle de la clinique de Münich, c'est-à-dire environ 40 %.

Dans la seconde partie, l'auteur passe en revue quelques cas de cancer du col respectivement traités par la curiethérapie et par la méthode chirurgicale; il évalue à environ 10 % la proportion de guérison dans les cas de cette catégorie.

Enfin, l'auteur insiste sur l'importance d'un traitement complémentaire soigneux et suffisant dans les cas de cette nature et appuie cette manière de voir sur la différence que l'on constate dans la proportion des guérisons suivant qu'il s'agit de malades appartenant à la classe moyenne ou à la classe ouvrière.

AUS DER MEDIZINISCHEN UNIVERSITÄTSKLINIK, BONN (PROF. P. MARTINI)

# MORBUS BASEDOW UND UNMITTELBARER TODESFALL NACH DER RÖNTGENBESTRAHLUNG[1]

von

*Hans Haas.*

In einem der letzten Hefte der Acta Radiologica berichten M. LUEDIN und C. ZWEIFEL die Ergebnisse ihrer Zusammenstellung über Todesfälle im Anschluss an Basedowbestrahlung. ZWEIFEL fand bis zum Herbst 1932 in der deutschen und ausländischen Literatur insgesamt 28 Todesfälle, die unmittelbar der Bestrahlung mit Röntgen und Radium zur Last gelegt werden; nach Ausschluss aller jener, die sich auch durch andere Ursachen erklären lassen, bleiben noch 11 Fälle, in denen ein direkter Zusammenhang zwischen Röntgenbestrahlung der Schilddrüse und folgendem Exitus letalis angenommen werden muss.

Einen neuen derartigen Fall haben wir erlebt. Bei der grossen Zahl der bereits bestrahlten Basedowfälle und Thyreotoxikosen ist es ganz unwesentlich, ob der eine oder andere der ausgeschiedenen 17 Fälle nicht doch der Röntgentherapie zur Last gelegt werden müsste; es ergeben sich aus unserer Beobachtung solche Gesichtspunkte, die dafür sprechen, so z. B. in dem ersten der von GOETTE veröffentlichten beiden Fälle. Aufgabe dieser Arbeit soll jedoch einzig sein, an der Symptomatologie derjenigen Fälle mitzuarbeiten, bei denen eine Röntgenbestrahlung tatsächlich einwandfrei als Todesursache erscheinen muss, um in der Folge auch diese wenigen therapeutischen Unglücksfälle noch möglichst vermeiden zu können.

Krankengeschichte Franziska St., 52 Jahre, aufgenommen 14. 3. 1933.

Familienanamnese: Vater mit 64 Jahren an Apoplexie gestorben, Mutter 45-jährig an Kropfoperation gestorben; ob Basedow vorlag, ist St. nicht bekannt. 7 Geschwister, 2 gestorben, eines an Bleivergiftung, das andere an Pneumonie, die übrigen 5 sind gesund; keine Struma.

Frühere Krankheiten: Als Kind nie ernstlich krank gewesen. Menarche mit 18 Jahren, Menses regelmässig, alle 4 Wochen, 3 Tage dauernd. Mit 25 Jahren geheiratet, Ehemann lebt und ist gesund. Eine Geburt mit 27 Jahren; Kind starb 21-jährig an

[1] Bei der Redaktion am 18. XII. 33 eingegangen.

Grippe. Zweite Geburt mit 31 Jahren, Kind lebt, ist gesund. Kein Abortus, Inf. ven. negatur. Seit 10 Jahren Menopause. Im 20. Lebensjahr (1901) trat erstmalig eine Anschwellung am Halse auf. Patientin wurde noch im gleichen Jahr daran operiert; angeblich bestanden damals weder Stenoseerscheinungen noch Basedowzeichen. 13 Jahre später (1914) entwickelte sich langsam ein Rezidiv; damals starkes Herzklopfen. Zum zweiten Mal operiert. Das Herzklopfen blieb lange Zeit ziemlich unverändert bestehen, desgleichen leichte psychische Erregbarkeit. 1916 interkurrente Pyelitis; hiervon abgesehen war Patientin immer ziemlich gesund, sie war zwar nicht sehr kräftig, verrichtete aber stets ihre Arbeit im Haushalt.

Jetzige Erkrankung: Seit 3—4 Monaten wieder zunehmende Schwellung am Hals, die zunächst keine Beschwerden machte. Vor 6 Wochen dazu »Grippe», 41° Fieber, starke Kopfschmerzen, Husten, Herzklopfen, Kurzatmigkeit. Die grippösen Erscheinungen klangen nach 8 Tagen wieder ab, Patientin »kommt aber nicht mehr richtig hoch». Sie hat enorm an Gewicht verloren, etwa 30 Pfd, trotz guten Appetits, schwitzt leicht, ist sehr aufgeregt, klagt hauptsächlich über lästiges Herzklopfen und starke Kurzatmigkeit.

Objektiver Befund: 52-jährige Frau in sehr schlechtem Allgemeinzustand, 160 cm gross, 47.0 kg schwer. Haut und sichtbare Schleimhäute blass, Muskulatur dürftig, Fettpolster gering. Kopf normal konfiguriert, geringer Klopfschmerz. Nerven V und VII o. B. Nasenatmung frei, Gehör auf grobe Prüfung intakt. Augenbewegungen frei, leichter Exophthalmus. Pupillen reagieren auf Lichteinfall und Konvergenz, beide rund, die linke jedoch etwas weiter als die rechte. Gräfe, Möbius und Stellwag 0. Bei Lidschluss leichter Tremor. Zunge feucht, wird gerade mit leichtem Zittern vorgestreckt. Rachen und Tonsillen o. B. Ober- und Unterkiefergebiss durch Prothese ersetzt. Zahnfleisch nicht entzündet. Reaktionslos verheilte Schilddrüsen-Operationsnarbe (Kragenschnitt). Links etwa hühnereigrosses, rechts etwas kleineres Kropfrezidiv, von derber Konsistenz. Die Gegend des Isthmus ist ebenfalls diffus derb geschwollen. Die Haut darüber ist verschieblich. Die Struma geht beim Schluckakt gut mit, ist aber am Jugulum beiderseits schlecht nach der Thoraxapertur hin abgrenzbar. Rechts zweifingerbreite, links einfingerbreite substernale Dämpfung. Die Halsvenen sind beiderseits stark gestaut und pulsieren deutlich. Der Kehlkopf steht median; kein Stridor, Stimme klar und laut. Brustkorb und Wirbelsäule o. B. Lungen perkutorisch und auskultatorisch regelrecht. Herzgrenzen: nach links 8.5 cm, nach rechts 3.5 cm von der Mittellinie, nach oben 3. Rippe. Aktion zwischen 100 und 110 pro Minute. Systolisches Geräusch über der Herzspitze, zweiter Pulmonalton leicht akzentuiert. Puls mittelkräftig, keine Differenz zwischen Zentral und Peripher. Blutdruck 160/75 mm Hg nach R. R. Im Elektrokardiogramm Arrhythmia perpetus. Kreislauf-Funktionsprüfung: Rückkehr zu den Ausgangswerten bei normaler Reaktion für Puls, Atmung, Blutdruck nach 5 Minuten. Leib weich, leicht eindrückbar, keine Resistenz, kein Tumor. Leber und Milz nicht vergrössert, Nieren und Genitale o. B. Extremitäten, abgesehen von Varizen und Venektasien an beiden Beinen, regelrecht. Normale, jedoch etwas lebhafte, beiderseits gleiche Reflexe; keine pathologischen Reflexe. Sensibilität intakt. Urin sauer, Eiweiss, Zucker 0 und Urobilinogen 0. Diazo negativ. Im Sediment vereinzelte Leukozyten und Bakterien, ganz vereinzelt Erythrozyten. Blutbild: Hb. 78 %, Erythrozyten 5,000,000, Färbeindex 0.8, Leukozyten 7,300; davon 1 % Jugendliche, 12 % Stabkernige, 53 % Segmentkernige, 27 % Lymphozyten, 7 % Monozyten. Vitalgranulierte Erythrozyten 5/1,000. Blutkörperchen-Senkung nach Westergreen $\frac{15 — 39}{85}$.

Blutchemie (nach 3 Tagen fleischfreier Kost): Harnsäure 5.4 mg%, Rest-N 22.4 mg%, NaCl 500 mg%. Grundumsatz: Steigerung + 72 %. Röntgenuntersuchung des Thorax: Alte Hilustuberkulose beiderseits. Aktive Lungenprozesse unwahrscheinlich. Struma retrosternalis. Geringe Aortensklerose wahrscheinlich.

Während der ersten Tage der Beobachtung bewegten sich die Temperaturen bei rektaler Messung um 37.5° C. und zeigten fallende Tendenz, der Puls schwankte zwischen 100 und 110, ebenso zur Beruhigung neigend. Das subjektive Befinden der Patientin ist leidlich.

Am. 23. 3. erhielt Patientin die erste Bestrahlung, und zwar 5 % der HED auf 3 Felder. Die Bestrahlung wurde in gleicher Weise am 24. und 25. 3. nochmals wiederholt. Temperatur und Puls blieben gegen die Vorbeobachtungszeit unverändert. Leukozyten im Blut 6,300 pro cmm. Ausser Klagen über leichte Kopfschmerzen keine Veränderung des Allgemeinbefindens.

27. 3.: vierte Bestrahlung in gleicher Weise 5 % der HED, Temperatur am Morgen 38.2°, Leukozyten 6,000. Ein differenziertes Blutbild wurde nicht angefertigt. Am Abend desselben Tages Temperatur 39.4°, sehr starke Kopfschmerzen, leichte Benommenheit. Leukozyten 4,200; davon 2 % polymorphkernige neutrophile Leukozyten, im übrigen lauter Lymphozyten, überwiegend kleine. Als Ursache für die Temperaturen sind infektiöse Prozesse nicht nachweisbar, insbesondere Mund, Rachen und Tonsillen o. B., ebenso Lungen.

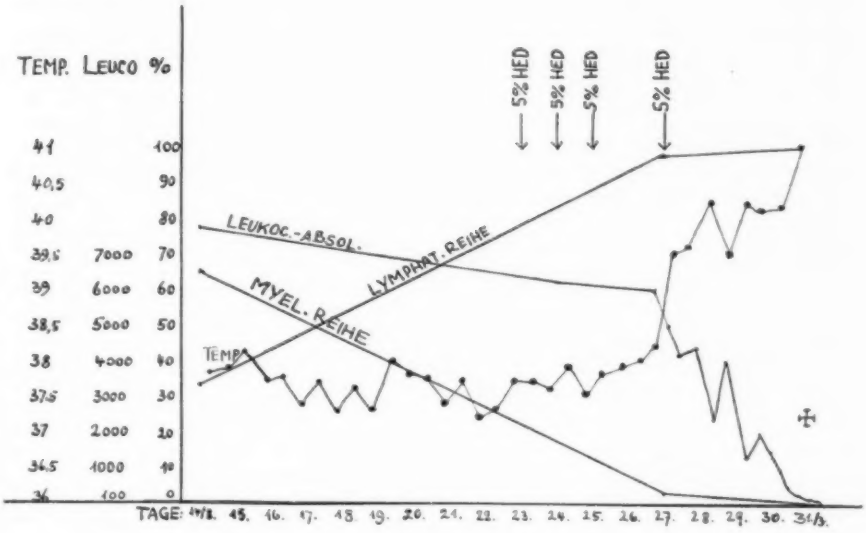
28. 3.: zeitliche und örtliche Orientierung erhalten, Temperatur am Morgen 39.5°, am Abend 40.2°, Puls 88 bzw. 104. Leukozyten morgens 4,200, abends 2,400. In dem am Morgen angefertigten Blutausstrich findet sich eine einzige Zelle der myeloischen Reihe, sonst nur grosse und kleine Lymphozyten. Hb. 70 %, Erythr. 3.8 Millionen. Die Suche nach infektiösen Prozessen, besonders seitens der Rachenorgane, ergibt auch heute nicht die geringsten Veränderungen. Milz und Leber nicht vergrössert.

29. 3.: Allgemeinzustand wesentlich verschlechtert. Morgens Temperatur 39.5°, Puls 100, total unregelmässig, abends Temperatur 40.4°, Puls 120. Blutdruck 175/60 mm Hg. Patientin macht einen benommenen Eindruck, klagt über Kopfschmerzen und Krämpfe im Leib. Leukozytenwerte, mehrmals bestimmt, liegen zwischen 1,440 und 1,000 in 1 cmm. In keinem Ausstrich eine Zelle der myeloischen Reihe. Thrombozyten 5,000 pro cmm. Am Abend Bluttransfusion: 160 ccm vom Sohn der Patientin (beide Blutgruppe A).

30. 3.: Gegenüber gestern keine wesentliche Änderung im subjektiven Befinden. Objektiv fällt eine leichte ikterische Verfärbung der Haut auf; die Verfärbung ist ausgesprochen gelb, nicht broncefarben. Im Rachen, auf den Tonsillen, am weichen Gaumen finden sich zerstreut stecknadelkopf- bis linsengrosse, weisslichgraue, nekrotische Herde. Die Struma selbst ist unverändert, die Haut über ihr vielleicht Spur gerötet. Lungen frei. Milz deutlich vergrössert und leicht palpabel, desgleichen ist die Leberkante heute, im Vergleich zu gestern, leicht fühlbar. Patientin ist meist benommen, reagiert sehr langsam und unsicher auf Anruf. Rigidität der Extremitäten und Schluckbeschwerden nicht beobachtet. Blutdruck 170/65 mm Hg. Leukozytenwerte um 8 Uhr 1,800, um 10 Uhr 2,000, um 12 Uhr 1,600, um 16 Uhr 1,400, um 20 Uhr 400. Temperatur morgens und abends 40.3°, Puls konstant um 120. Im Urin findet sich heute eine leichte Opaleszenz, im Sediment zahlreiche Erythrozyten, Urobilinogen in der Kälte +.

31. 3.: In der Nacht war Patientin sehr unruhig. Der Ikterus ist seit gestern sehr deutlich geworden. Im Rachen und an den Tonsillen heute zahlreiche nekrotische Herde. An der Aussenseite des rechten Oberschenkels, an einer Stelle, an der Patientin gestern eine Kampferspritze erhielt, findet sich ein etwa markstückgrosser, graugelber, trockener Herd, dessen Umgebung leicht gerötet ist. Patientin ist zeitweise stark benommen, lässt Stuhl und Urin unter sich. Temperatur 41°. Puls jagend, zeitweise über 160 pro Minute. Blutbild: Hb. 65 %, Erythrozyten 4.0 Millionen. Leukozyten mehrfach in der beschickten Kammer überhaupt nicht zu finden, also sicher nicht mehr als 200 in 1 cmm. Im Ausstrich noch vereinzelte Lymphozyten. Am Mittag nochmals Transfusion von 200 ccm Blut. Am Abend verfällt Patientin schnell. Der Blutdruck sinkt auf 90/52 mm Hg. Die Reflexe sind nicht mehr auslösbar. Exitus letalis.

Folgende Kurve veranschaulicht das Verhalten des Blutbildes und der Temperatur.




Sektionsbericht: mittelgrosse weibliche Leiche in mittlerem Ernährungszustand. Haut sehr wenig durchblutet, am ganzen Körper stark gelbgrün verfärbt. Totenflecke sehr wenig deutlich, Totenstarre vorhanden. Über dem l. Oberschenkel findet sich in einem etwa 3 M stückgrossen, unregelmässig landkartenartig begrenzten Bezirk eine bräunliche Verfärbung der Haut, die von einem leuchtend grünen, 1—2 mm breitem Saum umgeben ist. Über dem Hals, etwas oberhalb des Jugulums, eine reaktionslose Operationsnarbe. In der Bauchhöhle keine freie Flüssigkeit; Serosa überall zart, feucht und spiegelnd. Darmschlingen mässig gefüllt, Zwerchfellstand beiderseits 5. I. K. R. Lungen nach Abnahme des Sternums wenig zurückgesunken, nirgends verwachsen; in den Pleurahöhlen und im Herzbeutel keine freie Flüssigkeit. Pleuren und Epikard feucht, zart und spiegelnd. In den Herzhöhlen wenig Speckhaut und Cruorgerinnsel, Art. pulm. und ihre grösseren Äste frei.

Zunge: Papillen in den mittleren Abschnitten deutlich, an den Rändern wenig deutlich; Lymphknötchen im Zungengrund sehr deutlich, auf der Höhe der Lymphknötchen je ein stecknadelkopfgrosser, gelblicher, trüber (nekrotischer) Bezirk. Tonsillen beiderseits leicht vergrössert, etwas zerklüftet, auf dem Schnitt von gelben Pfröpfen durchsetzt; ausserdem finden sich auf der Oberfläche einzelne gelbliche Trübungen der Schleimhaut. Weicher Gaumen: Schleimhaut stark gerötet und von einzelnen grünlichgelben Trübungen durchsetzt, sowie von graugelblichen, leicht abstreifbaren membranartigen Auflagerungen bedeckt. Pharynx: Schleimhaut stark gerötet, Lymphknötchen sehr deutlich, stark vorspringend; im Zentrum der meisten Lymphknötchen ein stecknadelkopfgrosser gelber trüber Pfropf. Oesophagus: Schleimhaut blass. Kehlkopf und Trachea: Schleimhaut im ganzen blass, etwas trüb; in beiden Sinus piriformes sind die Lymphknötchen stark geschwollen und wie im Pharynx verändert. Thyreoidea: l. Lappen

fehlt, r. Lappen sehr gross, knotig, auf der Schnittfläche von zahlreichen kirsch- bis walnussgrossen, scharf begrenzten, z. T. trüben, z. T. glasigen Knoten durchsetzt. Lungen: beiderseits schwer, Pleuren zart; auf dem Schnitt sehr reichlicher Saft- und Blutgehalt, Luftgehalt deutlich vermindert, keine fühlbaren Herde. Herz: klein, schlaff, in der Muskulatur l. einzelne, r. zahlreiche schwarzrote fleckige Einlagerungen. Dicke der Muskulatur r. 2 mm, l. 8 mm. Mitralis und Tricuspidalis am Schliessungsrand verdickt, sowie auf der Mitralis zahlreiche zarte, glasige Auflagerungen. Sehnenfäden der Mitralis und Tricuspidalis verkürzt und verdickt. Brustaorta: Intima völlig zart. Milz: verhältnismässig gross, 12 × 8 × 5 cm; auf dem Schnitt ziemlich weiche Konsistenz, Zeichnung undeutlich. Nebennieren: wenig lipoidhaltig. Nieren: l. entsprechend gross, r. sehr klein, auf der Schnittfläche r. Niere ziemlich fest und etwas glasig. Nierenarterien starr, Wände deutlich verdickt. Magen: Schleimhaut körnig und warzig verdickt. Duodenum, Gallenwege: Schleimhäute zart. Leber: mittelgross, Oberfläche glatt, auf der Schnittfläche bräunlich gefärbt, undeutlich gezeichnet. Pankreas: fest; Milzarterie innerhalb derselben sehr stark geschlängelt, erweitert, mit verhärteten Wänden. Darm: Schleimhaut zart. Bauchaorta: Intima stellenweise leicht beetförmig verdickt. Beckenorgane: Harnblasenschleimhaut nicht gerötet, deutlich grüngelb verfärbt. Uterus klein. Rektumschleimhaut blass.

Anatomische Diagnose: Zahlreiche kleine Nekrosen der Zungen- und Rachenschleimhaut über den lymphatischen Apparaten. Kleine Nekrosen auf beiden Tonsillen. Pseudomembranöse Beläge auf der Schleimhaut des weichen Gaumens. Schleimhautnekrosen in beiden Sinus piriformes über versprengten Lymphknötchen. Rotes Knochenmark im ganzen r. Oberschenkel. 2 kleine Zysten im Mark des rechten Oberschenkels. Operativer Defekt des linken Schilddrüsenlappens. Starke, z. T. diffuse, z. T. knotige Vergrösserung des rechten Lappens. Allgemeiner hochgradiger Ikterus. Hochgradige Atrophie und Missbildung (?) der r. Niere. Schwielen und Blutungen in der Muskulatur des l. Ventrikels. Leichte Milzvergrösserung. Umschriebene kokardenartige grüne und braunrote Verfärbung der Haut über dem r. Oberschenkel (nach Injektionsstich). Lungenödem. Mittelschwere Arteriosklerose der grossen und mittelgrossen Arterien. Alte Endokarditis der Tricuspidalis und Mitralis mit frischen Auflagerungen auf der Mitralis. Chronische Gastritis.

Am eindruckvollsten in unserem Fall wie in all den von ZWEIFEL zusammengestellten Fällen ist der rapide Verlauf, mit dem die Patienten aus einer chronischen, ziemlich gleichförmig verlaufenden Erkrankung im unmittelbaren Anschluss an eine Bestrahlung zu Tode kommen. Die durchschnittliche Dauer nach der verhängnisvollen Röntgenbestrahlung beträgt noch nicht einmal eine Woche; in unserem Falle verstarb die Patientin am 5. Tag nach dem Auftreten der ersten Erscheinungen.

In den von ZWEIFEL aus der Literatur zusammengestellten Fällen handelt es sich, ähnlich wie in unserem Fall, noch durchweg um schwere Fälle von Morbus Basedow; die Erscheinungen, unter denen bei diesen der Tod im Anschluss an die Bestrahlung eingetreten ist, entbehren nicht einer gewissen Übereinstimmung unter einander und mit dem hier beobachteten.

Fast durchweg findet sich ein enormer Anstieg der Temperatur und der Pulsfrequenz, fast immer ist von Bewusstseinstrübung und Adynamie die Rede, mehrmals wird eine Verfärbung der Haut beschrieben.

Eine Symptomatologie lässt sich damit jedoch nicht aufstellen, dazu sind die mitgeteilten Befunde zu spärlich, und fehlen insbesondere durchweg Angaben über das Verhalten des Blutbildes; dies gibt dem von uns beobachteten Fall über die ihm mit den anderen gemeinsamen Symptome hinaus das charakteristische Gepräge und wäre, falls es sich nicht um ein zufälliges Zusammentreffen handelt, geeignet, ein warnendes Beispiel für spätere Fälle zu bilden.

In letzter Zeit berichtete nämlich E. Posse über den morphologischen Bestand des weissen Blutbildes bei Basedowikern und dessen Veränderung unter dem Einfluss der Röntgentherapie. Hiernach kann die bei Basedowikern bekannte absolute und relative Neutropenie mit Verschiebung nach rechts unter dem Einfluss der Röntgenbestrahlung eine doppelte Reaktion zeigen: eine Rückbildung zu normalen Verhältnissen, besonders hinsichtlich der Verschiebung in den Kernformen der Neutrophilen bei allgemeiner Tendenz zur Besserung. Bei Fällen aber, die auf Röntgenbestrahlung schlecht reagieren, beobachtet Posse eine zunehmende Neutropenie und zunehmende Verschiebung nach rechts. Die Lymphozyten sind in diesen Fällen auch nur relativ vermehrt.

In unserem Falle zeigte sich zu Anfang des Kliniksaufenthaltes im Blutbild eine geringe Lymphozytose und eine Linksverschiebung der myeloischen Reihe, ein Blutbild, das einem mittelschweren Basedow entsprechen würde. Die Leukozytenzahl hielt sich mit 7,800 an der oberen Grenze der Norm. Eine Kontraindikation gegen Röntgenbestrahlung bestand also nicht.

Im Verlauf der Bestrahlung, die in 4 Sitzungen mit je 5 % der HED und dazu auf 3 Feldern verteilt durchgeführt wurde, entwickelte sich dann eine typische Agranulozytose, genauer gesagt eine Panmyelophthise mit Neutropenie, Störung im roten Blutbild und Thrombopenie, die rapide zum Tode führte.

Dazu ist zu bemerken, dass die Verschiebung im differenzierten Blutbild zu Ungunsten der myelogenen Zellen dem Absinken der absoluten Leukozytenwerte erheblich vorausgegangen sein muss, ja dass sogar durch eine vorübergehende absolute Lymphozytose der Leukozytenwert als noch normal vorgetäuscht wurde. Deshalb erschien am Tage der 4. Bestrahlung der morgendliche Leukozytenwert mit 6,000 unverdächtig, während schon am Abend bei einer Gesamtleukozytenzahl von 4,200 das differenzierte Blutbild nur noch 2 % Zellen der Linksreihe aufwies. Ein am Morgen differenziertes Blutbild hätte wahrscheinlich schon die enorme Verschiebung erkennen lassen und zur Vorsicht gemahnt. Die übrigen Symptome, die zum grossen Teil mit den beiden in der Literatur angegebenen übereinstimmen, traten alle erst später auf und konnten allein mehr oder minder als Allgemeinerscheinungen des schweren Krankheitszustandes angesehen werden.

## ZUSAMMENFASSUNG

Es wird ein Todesfall im unmittelbaren Anschluss an Röntgenbestrahlung bei Morbus Basedow beschrieben. Das Verhalten des Blutbildes scheint einen Beitrag zu liefern zur Erkennung der Fälle, die auf die Bestrahlung ungünstig reagieren.

## SUMMARY

The author reports the case of a patient's death immediately consequent to roentgen irradiation for Basedow's disease. The features of the blood picture may contribute to recognition of the cases which react unfavourably to such irradiation.

## RÉSUMÉ

L'auteur rapporte un cas de mort en relation immédiate avec une irradiation aux rayons Roentgen dans une maladie de Basedow. L'aspect de l'image du sang semble apporter une contribution à la reconnaissance des cas qui réagissent fâcheusement à l'irradiation.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# THREE CASES OF ANOMALY OF THE BODIES OF THE VERTEBRAE IN THE CERVICAL REGION[1]

by

*Olof Odén*

(Tabulæ XIII—XIV)

»Syndrome de la réduction numérique cervicale» or »Syndrome de Klippel-Feil» is the name given by the French to changes in the cervical region of the spinal column which are due to variations in the development and differentiation of the vertebrae. The first report of such disturbances was made in 1912 by KLIPPEL and FEIL and since then these authors have made further contributions to the subject. Their first case presented changes in all the cervical and the upper 4 thoracic vertebrae so that all these together formed a single bony column. At the same time there was posterior spina bifida of the 7 or 8 uppermost vertebral arches.

The literature contains reports of similar cases but these are not numerous and therefore a publication of the 3 cases below is considered justifiable.

The anomaly is characterized by FEIL, ROLAND and VANBOECKSTAEL as follows:

*History:*

No history of a diseased condition in the vertebral column.

*Usual clinical signs:*

1) Short neck.
2) Low hair margin on the neck — sometimes down to the shoulders.
3) Limitation of lateral movement in the cervical region.

*Occasional clinical signs:*

4) Scoliosis or kyphosis.
5) Hump back.

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6) Raised shoulder blades.
7) Mammary areolae lower than normal.
8) Disproportion between extremities and trunk.
9) A certain difficulty in opening the mouth.

*Skeletal changes:*

1) Fusion and reduction of the cervical as well as the upper thoracic vertebrae which are joined all together, in pairs etc.
2) Posterior spina bifida of the affected vertebrae.
3) Raised shoulders with the formation of a more or less marked »Thorax cervicale».

Coalescence of the vertebral bodies has been ascribed by some scientists, DREHMANN for example, to an absence of differentiation of the different vertebral anlage and their parts. BEZI on the other hand considers that the malformation arises by assimilation.

According to BROMAN and others, a *mesodermal plate* develops on both sides of the medullary tube and chorda dorsalis, partly from extra-embryonic connective tissue and partly from proliferation of the primitive streak and the notochord. The medial portion of the mesodermal plate thickens and on it appear transverse folds which deepen so that the mesodermal segments (somites) or *primitive segments* are formed. These soon separate off from the non-segmented lateral portion of the mesodermal plate. The primitive segments together form the *primitive plate*. The first segment or segmental pair — a transverse division appears in the mesodermal plate of each side — appears at the upper border of what is to be the neck. Segment formation continues chiefly caudally but during the 4th embryonic week three segments form cranially so that in the 5th and 6th weeks there are 41—43 segments, this being the highest number of segments in embryos. Running between the primitive segments are the intersegmental dorsal branches from the aorta with their accompanying veins. Within each primitive somite a cavity develops and the cells are arranged like epithelium around it. There is a proliferation of the sclerotome cells from the ventro-medial side of the different primitive segments. These cells wander out medially and surround the notochord and the medullary tube and are the site of development of the vertebral column. The remainder of the primitive segments — their lateral dorsal parts — form a double layer of cells, the muscle plate, which gives rise to the striated muscle of the body.

The portion of each segment situated around the notochord and the medullary tube, differentiates into two parts during the 4th week of embryonic life. The caudal half becomes dense and forms the *primitive vertebral anlage* (the sclerome) while the cranial half remains looser.

The primitive vertebral anlage are paired masses of blastema which are three-cornered on cross section and from which develop, a) dorsally, the *neural arches* from which the vertebral arches later form, b) ventrally, the *costal processes* from which the ribs develop and c) medially the *chordal processes* which form the primitive vertebral bodies. The chordal processes from both sides unite in the midline enclosing the notochord and forming the *single primitive vertebral anlage.*

The cranial half of each sclerotome becomes more dense and is transformed into two membranes, one of which joints two adjacent neural processes and the other two adjacent costal processes. These are called the *interdorsal* and the *interventral membranes,* respectively. All the neural processes are jointed in this way the entire distance down each side while the costal processes are only united in their basal parts.

During the fifth week there is a thickening of the cranial parts of the chordal processes while the caudal portions become looser. The chordal processes move in a cranial direction and in this way the altered primitive vertebral anlage forms the primitive *intervertebral discs* and the blastemal tissue arranged like a ring-shaped membrane uniting the intervertebral discs, forms the interdiscal membrane. The mesenchymal tissue included in these parts is the anlage of the final vertebral body which thus arises from two adjacent halves of the primitive segment. As a proof and remnant of this, there are the vascular canals in the ventral part of the vertebral bodies which are röntgenologically demonstrable up to 12 and 14 years of age. These are the remains of vascular branching at the time of the formation of the primitive segment.

The interdiscal membrane gives rise to the longitudinal anterior and posterior ligaments.

The differentiation of the primitive vertebral anlage begins in the cervical region and proceeds caudally, reaching the caudal parts of the body during the second month of embryonic life.

In the anlage of the vertebral body, *cartilage formation* proceeds from *6 areas* having the same situation as the centers of ossification which develop later. There is *one* center of cartilage formation in each process, as well as two in the anlage of the vertebral body (one in each half). These latter do not fuse but instead, during the pre-ossification period, the cartilaginous vertebral body is divided into two halves by a sagittally placed perichondrial septum. Some authors state that there are several centers, for example two in each rudimentary arch, and that these anlage normally coalesce at a very early period.

With the development of both centers of chondrification in the anlage of the vertebral body, the part of the notochord which was enclosed here soon disappears, while the part which was included in the primitive

intervertebral discs thickens and persists as the nucleus pulposus. The connective tissue sheath of the chorda dorsalis remains longest in the anlage of the vertebral body, but even that disappears during ossification.

Before the neural arches are chondrified, they begin to send out shoots which will form the transverse and articular processes. The neural arches join the cartilaginous anlage of the vertebral bodies and cartilaginous vertebrae are formed with a dorsal open vertebral arch. The articular process grows forward in the interdorsal membrane. The articular processes of adjacent vertebrae meet one another and unite. Joint cavities form later in the blastemal tissue between them.

*Ossification* of the vertebral anlage proceeds from 5 centers, one in each lamina of the arch, one in the rib on each side and one in the vertebral body. According to some authors there sometimes occurs the anomaly of two centers of ossification in each lamina or the anlage of two ossification centers which unite very early. The sites of the centers of ossification correspond to the sites of the centers of chondrification.

Ossification of the vertebral anlage occurs first in the rib anlage in the 6—8th foetal week and somewhat later in the anlage of the vertebral arch where it begins in the atlas and gradually progresses downwards. Ossification begins last in the anlage of the vertebral body and then usually from a single center of ossification. The ossification of the vertebral bodies commences in the lower thoracic and upper lumbar regions in the 8—10th week and then gradually involves the vertebrae lying above and below.

By the middle of the 3rd month, ossification centers have appeared in the vertebral arch anlage up to the middle of the thoracic vertebrae as well as in the anlage of the vertebral bodies in the entire thoracic and lumbar regions. Thus at this period it is only the upper thoracic vertebrae which have ossification centers both in the bodies and the arches.

By the end of the 4th month centers of ossification can be found in the body of the first cervical vertebra and down to the 4th and 5th sacral vertebrae.

The halves (laminae) of the arches are united by ossification during the first year of life, beginning in the lumbar region, while the arch pedicles and vertebral bodies are joined by ossification in the 3rd—6th years, beginning in the thoracic region. The line of union between the arch and the vertebral body is situated slightly inside the later vertebral body.

The transverse and spinous processes acquire centers of ossification — epiphyseal centers — during or immediately after puberty and are united with the arches by ossification at 20 years of age. The spinous processes in the cervical region usually have two epiphyseal centers.

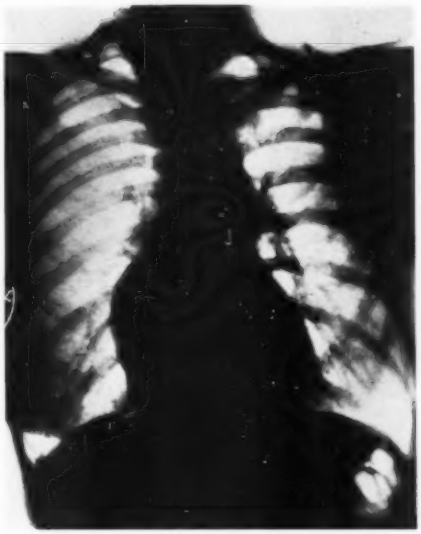

Fig. 1.

Fig. 2.

Fig. 3.

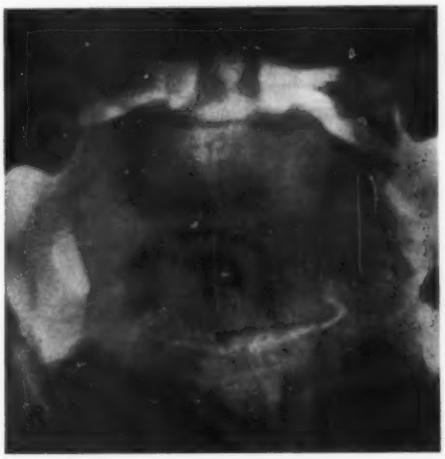

Fig. 4.

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Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Between the vertebral body and the intervertebral discs there is a layer of hyaline cartilage — the growth zone of the vertebral body. The peripheral border of this zone is considerably thicker than the center and fills out an indentation which is present in the edge of the vertebral body. In this peripheral cartilage, which is according to SCHMORL without significance for the growth of the vertebral body and therefore called by him »marginal rim» and by others »epiphysis of the vertebral body», there develop in the 6—9th year a number of centers of ossification which by the 12th year have fused into one. The ossified marginal rim begins to fuse by ossification with the vertebral body in the 14—15th year. There are however great variations.

In the cartilaginous vertebral column all the vertebral bodies have the same height. At birth a certain slight difference can be noticed and during the first years there occurs a continuous differentiation in the size of the vertebrae.

The existence of a half vertebra, the absence of parts of the arches or vertebrae, the fusion between several vertebrae or vertebral halves (either entire or partial) can be explained by absence of the anlage of one half or a part of a vertebra or by suppression during development or by lack of segmentation, unilateral or bilateral or affecting only a portion of one side.

If one agrees with BEZI and considers that an assimilation was the cause, it must have taken place at a very early period, in the first foetal months. The very variable changes in the cervical vertebral column in Klippel-Feil's syndrome can be explained in both ways in different cases. According to DREHMANN's explanation the condition must already exist in the germ plasm while, according to BEZI, it is due to influence on the anlage of the vertebrae during intrauterine development.

The formation of centers of chondrification and ossification takes place first in the thoracic and lumbar regions. Anomalies of the vertebral bodies are encountered most often in the lower lumbar and sacral as well as in the cervical regions.

## Case Histories

*Case 1.* Female of 47 years.

*History:* One brother died of tuberculosis at 3 years of age when the patient was 5 years old. Otherwise there was nothing of interest in the family history. The patient has 3 children, the eldest of which is a girl who is mentally deficient. The other two are well and healthy.

The patient's neck has always been short and somewhat crooked. The inconvenience of this decreased when she reached 20 years of age. She has always had some limitation of movement of the neck.

She has always been healthy until recent years.

She had her neck röntgen-examined 15—20 years ago and was told that she had an old healed and harmless tuberculosis of the cervical vertebrae.

During the last years the patient has had various kinds of trouble with pricking sensations in the legs and arms and pain over the neck and shoulders.

Menstruation has become irregular during recent years. The patient feels anxious and nervous, and cries easily without any reason. She always used to be happy but now she becomes discouraged very easily. She wishes to have her neck examined and is afraid the tuberculous process has become active again.

*Status:* Good general condition. Average development. Rather well nourished. Can open her mouth a normal distance. The mouth is otherwise normal. Breasts normal.

Heart, Lungs, Abdomen: No abnormality.

Nervous System: No paralyses. Crude strength everywhere unimpaired.

Sensibility: No abnormality. Reflexes: No abnormality.

Local Condition: Short neck with head bent to the left. Right convex scoliosis of the cervical region, slight hump over the lower cervical and upper thoracic region. Hair margin reaches down to the middle of the neck. No tenderness over the vertebral column on indirect or direct pressure. Limitation of movement in the cervical vertebrae which especially affects bending to the sides or backward and forward. No pain accompanying these movements.

*Röntgen-examination* 20. 2. *Lungs:* (See fig. 1). Uniform diaphragmatic movements. Right sinus obliterated at the bottom. Air content and vascular picture normal. No demonstrable parenchymal changes. In both hiluses some small partially calcified lymph node shadows.

*Spinal column:* (See fig. 2 and 3). Double S-shaped scoliosis of the vertebral column; left convexity in the upper cervical middle thoracic and lumbar regions; right convexity in the lower thoracic region and especially marked at the junction of the thoracic and cervical regions. Some torsion to the right in the thoracic region. The bodies of the 6th cervical to the 1st thoracic vertebrae form an obliquely situated mass which on the radiogram measures 4 cm. in height along the left border and $5^1/_2$ cm. along the right. Within the middle of the right part of this mass can be seen a partially demarcated wedge-shaped portion with the apex toward the midline. In addition to this portion of the vertebral body (the remains of the 7th cervical) there are also on the right the arch and the transverse process as well as part of the spinous process. The intervertebral distance between the 1st and 2nd thoracic vertebrae is normal. The bodies of the 2nd—5th thoracic vertebrae thus form a trapezium-shaped mass measuring $6^1/_2$ cm. along the right and 8 cm. along the left edge. Within this mass the intervertebral spaces are discernible as mm. wide crevices. The upper contour of the 5th thoracic vertebra is slightly wedge-shaped and there is a corresponding indentation of the lower contour of the 4th thoracic. The upper border of the 4th and the lower border of the 2nd thoracic are likewise wedge-shaped. Between the last two on the right a wedge-shaped vertebral body can be fairly well distinguished. Its apex extends into the center of the intervertebral space. A rib passes to the upper right border of this wedge-shaped vertebra. There are also a transverse process and half of the vertebral arch on the right side. There is a posterior spina bifida of the 6th cervical vertebra and a trace of it on the 5th cervical, 1st, 2nd and 4th thoracic. There are 12 ribs on the right side and 11 on the left. There is no demonstrable destruction within the vertebrae. There are no abnormal paravertabral shadows.

Röntgen examination shows a developmental disturbance of the spinal column involving the 6th cervical to the 5th thoracic vertebrae.

Of the 7th cervical and 3rd thoracic there remains only a wedge-shaped right half with arch and transverse process. There is also a rib on the right side of the 3rd thoracic. The bodies of the 6th cervical to the 1st thoracic vertebrae are fused into one mass. There is a posterior spina bifida of the affected vertebrae. The third rib on the left side is absent. There is no sign of tuberculosis. There are remnants of a pleuritis of the right base and otherwise the lung findings are negative.

The case is that of a middle aged woman who has been given a diagnosis of healed tuberculosis of the cervical vertebrae and who during the last years has had nervous disturbances in connection with the commencing menopause. She believes that the old tuberculous process has become activated.

The examination shows a typical malformation in the region of the 6th cervical to the 7th thoracic with two defective vertebrae (half vertebrae), part of the 7th cervical and part of the 3rd thoracic, as well as absence of the 3rd rib on the left side. The vertebrae within this segment are partially fused. There is no reason to suspect a previous tuberculosis. There are no changes in the lung parenchyma.

The explanation that the condition in the cervical vertebrae was due to a congenital malformation and not to a tuberculous process quited the patient to a certain extent and she became less neurotic.

This case showed the following typical changes of the KLIPPEL-FEIL anomaly:

*History*: The malformation has been present since birth. There has never been any acute process in the cervical vertebral region.

*Clinically:* 1. Short crooked neck; 2. Rather low hair line on the neck; 3. Limitation of movement laterally; 4. Kypho-scoliosis.

*Skeleton:* 1. Typical changes with shallow, sometimes fused vertebrae. Incomplete development and deformity of two vertebrae; 2. Posterior spina bifida.

*Case 2.* Male labourer 58 years of age.

*History:* Nothing of interest in the heredity. Pneumonia at 51 years of age. Otherwise healthy until about 5 years ago when he began to have pain and stiffness in the small of the back. The pain could appear very suddenly and often radiated into the hips. It was sometimes absent for months. The patient however has not felt well but has gone around with a continual feeling of weakness in the spine and anxiety for fear the pain would return.

Has never had fever or frost-bite although he feels very cold in winter. The abdomen is often distended. Bowel evacuation is regular.

Has never had disturbances of speech or pareses. He has no headache, but often a feeling of pressure over the crown of the head.

Increased frequency of urination. Sometimes the stream is too rapid, especially when he is nervous. Denies venereal infection. Appetite good. Has not lost weight.

*Status*, 5. 6. 1930:

General condition good. Well developed and well nourished. No dyspnea or cyanosis. No edema.

Nervous System: Mentally no abnormality. No disturbance of speech.

Pupils. Right somewhat larger than left. Both react slowly to light, and better to accommodation. Left pupil somewhat pale. Nystagmus movements towards both sides. Lower left-sided facial paralysis. Deviation of the tongue to the left. No cerebellar symptoms. Irregular tremor of the fingers. No rigidity or other extra-pyramidal symptoms. No paralyses. Crude strength everywhere good. No disturbance of sensibility. Normal gait. Negative Romberg.

Reflexes. Triceps, ulnar and radial reflexes positive and lively on both sides. Normal abdominal reflexes. Patellar reflex ++. Achilles reflex weak. Negative Babinski on both sides. Negative Lasègue.

Local condition: Patient feels that his back is somewhat stiff. His posture is normal and there is no visible scoliosis. There is no tenderness over the vertebral column on direct or indirect pressure. Some limitation of movement in the lumbar region. Possibly some limitation of movement of the cervical vertebrae, rather uniformly distributed. Hip joints free. On *rectal examination* the prostate is slightly enlarged and firm. *Blood.* Rbc. 4,800,000, Wbc. 7,000, Hgb. 87 %, S. R. 31 in 1 hour, 55 in 2 hours, Wassermann negative, Kahn negative, Residual Nitrogen 42 mgm. %. *Urine* no abnormality.

*Röntgen examination: Skull.* The general form and thickness of the calvarium are normal. The sutures, vascular channels and impressiones digitatae show no abnormality. The sella is normal. There is nothing definitely pathological in the ear regions. The maxillary sinus and the ethmoidal cells on the right side have a decreased air content and indistinct contours. The frontal sinus is not visible on this side. The other accessory nasal cavities contain a normal amount of air and have sharp contours.

*Spinal column:* Slight right convex scoliosis in the cervical region (see fig. 4 and 5). The atlas shows a normal picture. The joint space between the 2nd and 3rd vertebral bodies is only visible as a small sclerosed zone in the center of the vertebral mass. The arches and the spinal processes seem to be free. There is no demonstrable posterior spina bifida. The bony structure within these vertebral bodies gives a normal picture. No visible areas of destruction and no sclerosis. Small elevations on the edges of the vertebral bodies.

Slight S-shaped scoliosis of the rest of the spinal column with a right convexity in the upper part of the thoracic region and a left convexity in the lower part of the thoracic and lumbar regions. The height of the vertebral bodies and of the intervertebral discs is normal. There is a sharpening of the borders of the vertebral bodies especially in the lumbar region. The sacrum gives a normal picture.

No deposits in the hip joints which give a normal picture. Accessory finding: Distinct calcification of the vessels in the pelvis minor.

Röntgen examination shows a right-sided pansinusitis. Otherwise no abnormality of the cranium. Almost complete fusion of the bodies of the 2nd and 3rd cervical vertebrae (congenital anomaly). Slight S-shaped scoliosis of the spinal column. Beginning spondylitis deformans. Arteriosclerosis of the pelvic vessels.

In this case the patient presented clinically a slight limitation of movement in the cervical region which was therefore röntgen-examined. A fusion of the 2nd and 3rd cervical vertebrae was found. The absence

of any history of disease in this region together with the findings in the radiogram suggest that the condition is a developmental anomaly. The patient has never had any difficulty with his neck. This anomaly was only an accessory finding in the examination.

*Case 3.* Sailor 30 years of age.

*History.* Nothing of interest in the heredity. No tuberculosis in the family or relatives. The patient has had a short somewhat crooked neck ever since birth. Has never had any pain or inconvenience from it. The movability is good. The neck became better when the patient grew up. In 1929 swelling of the right testis. Was treated conservatively for a time but the swelling increased and at last there was a spontaneous perforation with discharge of purulent fluid. Admitted to hospital where the diagnosis was proven to be tuberculous epididymitis. Epididymectomy was done and the patient recovered. At the end of 1929 there was again swelling and a purulent discharge on the right side. It healed quickly and the patient was able to return to work in April 1930. While at work on 25. 5. 1932 he was injured by a wooden hatchway which fell on his head. Admitted to hospital. Röntgen report. »Probable fracture of the 5th and 6th cervical vertebrae. Old lesions in the cervical vertebrae. Healed tuberculosis?».

In connection with the accident the patient had temporary weakness of the arms. He lay in a plaster bed for 3 months and afterwards had a plaster collar.

While lying in the plaster bed the left epididymis swelled and became tender. Urine: White and isolated red blood cells in the sediment. On one occasion acid-fast rods of the tubercle bacillus type. The trouble decreased gradually. In the end of August 1932 the patient had an attack of pain localized in the left side and radiating out into the groin. Gravel in the urine, red and white blood cells in the sediment.

The patient was admitted to Serafimer Hospital 19. 9. 1930. *Status* of the previous condition: General condition good. Wearing the plaster collar. Kypho-scoliosis of the spinal column, with a right convexity at the junction of the cervical and thoracic vertebrae.

Neck short and crooked. The head is held straight but forms an angle with the longitudinal axis of the neck. The contour of the spinous processes can be palpated the whole way. No pain on movement. Limitation of movement in all directions most marked when bending the head laterally and least when bowing backwards or forwards. The patient can open his mouth until there is a 2 cm. distance between the free of the front teeth.

The mammary areolae are situated at a normal height.

No difficulty with urination.

Left epididymis. Definitely enlarged, firm in consistency and somewhat tender. Surface rather smooth.

Urine: No abnormality. Heller negative. No tubercle bacilli in the sediment.

Cystoscopic examination: Bladder mucous membrane slightly reddened. Right uretral orifice normal. Swelling and edema of left uretral orifice but no typical tuberculous changes.

Urine from the right ureter: Many red blood corpuscles, single cocci, no tubercle bacilli. Urine from the left ureter: Many red blood cells, 5—6 white blood corpuscles per field. Cocci present. No tubercle bacilli.

The pyelogram showed a concrement in the left kidney.

Operation: Epididymectomy on the left side.

Pathology report: Tuberculosis.

*Röntgen examination* of the cervical spinal column: S-shaped scoliosis in the cervical and upper thoracic region (see fig. 6, 7 and 8). A right convexity in the uppermost thoracic region. Moderate hump over the 5th cervical to the 1st thoracic the spinous process of the 7th cervical vertebra projecting most. A bean-sized bony structure, covered with cortex, on the upper side of the tip of the spinous process of the 7th cervical vertebra (see fig. 8).

Deformity of the cervical vertebrae (see fig. 6 and 7). The first cervical vertebra seems normal. The bodies and spinous processes of the 2nd and 3rd cervical form a single mass. The vertebral arches are partially separated. The intervertebral space can be distinguished only as a small crevice in the left corner (see fig. 7). The bodies of the 4th and 5th cervical vertebrae are fused except in the right anterior part where the intervertebral space can be seen as a crevice about 2 mm. wide. Their left arches are joined. There is a posterior spina bifida of the 4th cervical and a vestige of this on the 5th cervical vertebra. On a frontal film the body of the latter is spool-shaped with the deepest indentation underneath. The lower border of the 4th cervical vertebra is correspondingly blunt and wedge-shaped. The upper contour of the 6th cervical is even. The indentation on the inferior surface of the 5th cervical vertebra is acute-angled. The contours here are somewhat uneven and do not have the thin superficial sclerosed zone of the upper border. The 6th and 7th cervical vertebrae are joined and their spinous processes as well. Both show a posterior spina bifida. There is a rib 7 cm. long extending out from the right side of the 7th cervical. The vertebral bodies of the 7th cervical and the 1st thoracic are joined at the right margin (see fig. 6). The 1st, 2nd and 3rd thoracic vertebrae form a single wedge-shaped mass measuring 5 cm. in height along the left border and $6^1/_2$ cm. along the right. The arches and spinous processes of these 3 vertebrae cannot be differentiated even on steroscopic examination. There may possibly be a posterior spina bifida on the 1st thoracic or else the spinous processes of the 1st and 2nd thoracic vertebrae are not united in their entirety. The inferior contour of the 3rd thoracic shows a slight indentation with a corresponding wedge formation on the upper border of the body of the 4th thoracic vertebra. Definite deposits on the edges of the 5th and 6th cervical vertebrae where they face one another. No visible areas of destruction within the vertebrae. No abnormal paravertebral shadows.

Röntgen examination shows a congenital malformation of the cervical and upper thoracic vertebral column with more or less complete union between the 2nd and 3rd, 4th and 5th, 6th and 7th cervical and between the 1st, 2nd and 3rd thoracic vertebrae. Definite posterior spina bifida of the 4th, 6th and 7th cervical vertebrae. Cervical rib on the right side. An extra bone at the tip of the spinous process of the 7th cervical vertebra.

Fracture of the 5th cervical vertebra but not extending completely through the body.

Deformative spondylitis of the 5th and 6th cervical vertebrae.

No sign of tuberculosis. No sign of tuberculous processes in the lungs.

During his stay in hospital the patient had a mild attack of renal colic on the left side. He was discharged improved and continued to wear the plaster collar.

Admitted again after 2 months because of increasing difficulty with the left kidney.

*Status 1. 12.*

Cystoscopy showed the same picture as before.

Urine. No tubercle bacilli. Sedimentation of red blood sels, 6 mm./ 1 hour.

*Röntgen examination of the kindneys* 22—26. 9: Both kidney shadows of normal size and situated in their normal place at about the same height. Their lateral, smooth, rounded borders could be differentiated but not their lower poles or their medial borders. Within the lower half of the left kidney shadow there are two irregular calcified areas the size of large beans. Otherwise there are no demonstrable concrements in the kidneys or urinary passages.

*Pyelography:* The left kidney pelvis is large and bulky and the size of an orange. The calyces, especially the upper two, are large and point postero-laterally or directly posteriorly. The calcified shadows previously observed seem to be due to two concrements situated in the lower posterior part of the renal pelvis. The uppermost part of the left ureter describes a long anterior curve. This ureter is distended to the size of a little finger along its entire length but narrows rapidly at the uretral orifice in the bladder. The contours are smooth.

The right kidney pelvis is somewhat bulky and deformed, especially in the lower part. Its calyces are normal in shape and are directed postero-laterally. The ureter describes a long anterior curve in its upper part, more marked than on the left side. The right ureter is somewhat wide particularly in the lower portion.

Röntgen examination shows a marked left-sided hydronephrosis with the sack of the renal pelvis directed ventrally. There are two irregularly shaped concrements, the size of large beans, in the lower and posterior part of the renal pelvis. The entire left ureter is widened (due to a relative inflammatory stenosis of the uretral orifice?).

The right renal pelvis is somewhat bulky but shows no hydronephrosis.

Both ureters describe a more or less marked ventral curve in their uppermost parts.

Röntgen examination on December 4 showed the same condition with the left renal pelvis perhaps somewhat larger.

*Operation* 9. 12. 1930. Usual renal incision. Left kidney normal in size. Left renal pelvis enlarged. A narrow bridge which seems to consist only of connective tissue passes from the inferior pole over to the right kidney (horse-shoe kidney). Pyelotomy with removal of both concrements.

Patient discharged 20. 1. 1931. He had still pain in the neck and down in the thorax if he tried to go without the plaster collar.

This case presents many interesting points. The patient has had since birth a deformity of the neck which has caused no difficulty. He developed a right-sided tuberculous epididymitis in 1929. One year later he suffered a traumatic head injury with fracture of the 5th and possibly 6th cervical vertebrae. The röntgen examination immedia-

tely after the accident showed fusion of the vertebral bodies suggestive of healed tuberculosis. Such an explanation is quite plausible when one takes into consideration the history and the tuberculous process in the right epididymis. In addition the patient had difficulty with the other epididymis while he was lying in the plaster bed. This showed itself to be tuberculosis. There were slight changes in the urine and once suspicious tubercle bacilli were found. There were no demonstrable changes in the lungs.

During the time the patient was in bed with the neck injury he had an attack of pain in the left side of the abdomen. The urine contained single red and white blood corpuscles in the sediment. No tubercle bacilli. Cystoscopy showed swelling and reddening around the left urethral orifice but no changes typical of tuberculosis. Röntgen examination without the use of a contrasting substance showed areas of calcification rather laterally situated in the left kidney. Since a definite diagnosis of concrement could not be made from this examination, and it was possible that calcified tuberculous processes were present, pyelography was done. The calcified areas were found to be situated in the renal pelvis and operation verified this diagnosis.

A later röntgen examination demonstrated a congenital anomaly with wedge- and spool-shaped vertebrae. The different vertebral bodies could not be defined. The condition involved the entire area, from the 2nd cervical to the 4th thoracic vertebra. There was in addition a cervical rib and a fracture of the 5th cervical vertebra. The fracture has thus affected a congenitally malformed vertebra. There is no tuberculous process. Deformative changes have developed in the fractured vertebra.

It would be of importance to the patient, from the accident compensation standpoint, if the changes in the vertebral bodies were considered to be a congenital anomaly and not due to an earlier tuberculous process.

The patient is a typical case of Klippel-Feil's syndrome.

*History:* No history of any acute inflammatory processes in the spinal column.

*Clinically:* 1. Short, somewhat crooked neck; 2. Low hair margin; 3. Limitation of movement in the cervical vertebral region; 4. Scoliosis.

*Röntgenologically:* 1. Typical changes in the lower cervical and upper thoracic vertebrae; 2. Posterior spina bifida of several of the affected vertebrae.

The patient has disease of the urinary passages besides his neck injury and his tuberculous epididymitis. On account of the tuberculous epididymitis a renal tuberculosis was at once suspected. Further investigation as well as the operation showed that concrements in the uri-

nary passages were the cause of the trouble. On pyelography the ureters presented a slight deviation from their course, the left renal pelvis was hydronephrotic, the right somewhat bulky and both more or less obliquely situated. The changes were so slight that no definite conclusions could be drawn from the röntgen examination. The operation revealed still another anomaly in this patient, i. e. a horse shoe kidney with a connective tissue union between the two lower poles. This anomaly explained very well the changes in the course of the ureter as well as the position of the renal pelvis, seen on the radiogram.

## SUMMARY

After a statement of the symptoms and characteristics of the KLIPPEL-FEIL syndrome, the embryonic development of the spinal column and the time of appearance of ossification in the different parts of the vertebral skeleton are described. The various authors' explanations of the anomaly in question and of the defective differentiation of the vertebrae and their different parts are quoted. 3 additional cases, two of which have typical symptoms are reported and the technical significance for the insurance problem is mentioned.

## ZUSAMMENFASSUNG

Verf. gibt erst die Symptome und Veränderungen bei »Syndrome de KLIPPEL-FEIL» an. Danach werden die Anlegung und Entwicklung der Wirbelsäule und der Zeitpunkt des Eintretens der Verknöcherung in den verschiedenen Teilen des Wirbelsäuleskelettes in kurzen Zügen beschrieben. Mit einigen Zeilen werden die Erklärungen verschiedener Forscher für die mangelnde Differenzierung der Wirbel und ihrer verschiedenen Teile wiedergegeben. Verf. teilt schliesslich drei Fälle, wovon zwei mit typischen Symptomen und mit derartigen Veränderungen mit. Die versicherungstechnische Bedeutung wird erwähnt.

## RÉSUMÉ

L'auteur indique d'abord les symptômes et les changements dans les cas de »Syndrome de KLIPPEL-FEIL». Ensuite il récapitule brièvement la construction et le développement de la colonne vertébrale et le moment du commencement de l'ossification des différentes parties de l'ossature épinière. Il cite en quelques lignes les explications de différents savants sur la différentiation insuffisante des vertèbres et de leurs parties différentes. A la fin l'auteur commente trois cas avec changement semblable, dont deux à symptômes typiques. Il effleure également l'importance technique de la question d'assurance.

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# TWO CASES OF FRACTURE OF THE TRAPEZIUM (OS MULTANGULUM MAJUS)[1]

by

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(Tabula XV)

In a paper on »Verletzungen der Handwurzelknochen» VAN EDEN remarks with regard to fractures of the os multangulum majus: »There is very little to be said. We have encountered the diagnosis three times and once the röntgenologist placed a question mark after the report. In reality these pictures are not convincing. One of the patients kept on at work without further difficulty.» In his text book, »Röntgen-Diagnostik in der Chirurgie», HERMAN MEYER writes of injuries to the trapezium, »It is very uncommon to find isolated injuries to the distal row of the bones of the wrist (capitatum, hamatum, multangulum majus, multangulum minus and pisiform).» ALBAN KÖHLER in the last edition of »Grenzen des Normalen und Anfänge des Pathologischen im Röntgenbilde» concludes briefly, »isolated fractures of the multangulum majus are almost impossible but can be simulated when a corner of the base of the first metacarpal is broken off. They may occur in combination with other fractures also of the base of the first metacarpal but even then very rarely.» In the chapter on fractures of the wrist bones the more common text books in surgery discuss only the fractures of the naviculare and the lunatum and sum up the fractures of the other bones under the term, »Rarities». Nothing is said of isolated fractures of the multangulum majus.

In Röntgenpraxis 15, 1931, W. JAEGER has reviewed the literature on fractures of the multangulum majus and has found 32 cases. Of these 13 were associated with other fractures of the wrist, usually with a simultaneous Bennett's fracture. Of the 9 isolated fractures of the multangulum majus, four showed fragments of bone torn off the dorsal side, two were fractures in a longitudinal direction and one was a comminuted fracture. In two of the cases the pictures were unsatisfactory

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and the patient did not return for examination. JAEGER himself reports 2 cases of isolated fracture of the multangulum majus and in both of these a small fragment was torn off the dorsal surface of the bone. Thus, altogether 11 cases of isolated fracture of the multangulum majus have been published. The following two cases may be added to the same group.

The *first case* is that of a 39 year old carpenter who fell from a height of about 3 meters and struck his left hand (18. 9. 1931). The patient cannot give any more detailed account of how he hurt the hand but he believes that it struck the ground with the thumb outstretched and that he received the blow on the base of the thumb. There was pain and swelling after the accident. The patient came to the surgical polyclinic of Serafimer Hospital on the 19th after having had a compress moistened with lead acetate solution on the hand during the night.

*Status* $^{19}/_{9}$. Extremely marked swelling and some discoloration of the whole left hand and wrist, especially around the thumb. Maximal tenderness over the base of the first metacarpal and in the anatomical snuff-box. Tenderness and pain on pressure in the long axis of the thumb.

*Röntgen examination* (fig. 1, 2 and 3) showed a comminuted fracture of the multangulum major with the bone divided into 3 large and some small fragments and the line of fracture in the long axis of the thumb. The chief fragments, of which the ulnar half constitutes the largest, are pressed somewhat apart so that there is a distinct increase in width and a decrease in height. The middle fragment has been moved proximally more than the other two so that the distal articular contour of the multangulum majus is zigzagged when compared with the normal right hand (fig. 4 and 5). Otherwise there is no demonstrable fracture of the left hand or bones of the wrist.

After the swelling left, the patient was given a plaster splint for about 4 weeks and afterwards warm hand baths.

Unfortunately there are no further statements as to the later course and the patient cannot be found.

The *second case* is that of a 66 year old washer woman who fell and came down on her left hand so that she received a heavy blow on the left thenar area.

The patient said that she had injured the left hand 13 or 14 years before. She was admitted to the polyclinic of Ersta Hospital and röntgen-photographed. She then received medical care for several weeks. She has been well except for »rheumatic pains» in the hand and has been able to continue her work as a washer woman the whole time. The radiogram from the preceding examination shows, unfortunately, only the lower half of the forearm.

*Status* $^{21}/_{9}$. Swelling and some discoloration of the thenar portion of the left hand, chiefly proximally. Tenderness on pressure over the swollen area and some indirect tenderness on pressure on the first metacarpal in its long axis. No actual pain when the thumb or wrist are moved.

*Röntgen examination. Left hand* (fig. 6, 7 and 8): The multangulum majus is deformed and compressed in the longitudinal axis of the hand with deformity of the joint

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

*Case 1.* Comminuted-fracture of the multangulum majus of the left hand.
Fig. 1—3 Left hand. Fig. 4—5 Right hand.

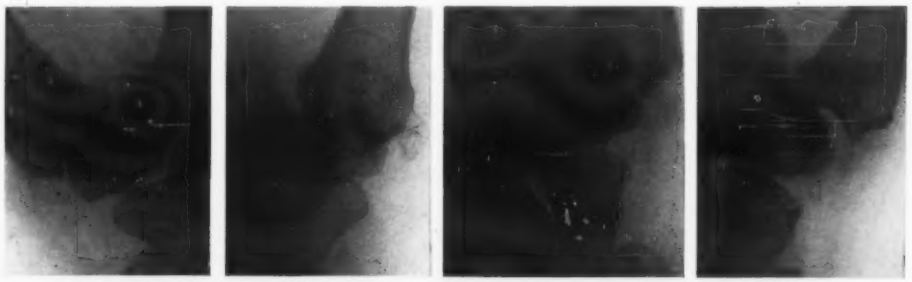

Fig. 6. Fig. 7. Fig. 8. Fig. 9.

*Case 2.* Old healed comminuted fracture of the multangulum majus, with arthritis deformans in the first carpo-metacarpal joint, of the left hand.
Fig. 6—8 Left hand. Fig. 9 Right hand.

surface toward the first metacarpal. The proximal articular surface of the latter bone is deformed to a corresponding degree. There is rather marked sclerosis of the distal half of the multangulum majus as well as the basal portion of the first metacarpal and small round areas or rarefaction. On the radial side of the multangulum majus in the angle between it and the base of the first metacarpal, there is an oval-shaped body of free bone, the size of a pea. On the distal corner of the multangulum majus there is a rounded bean-sized exostosis with several rice-grain-sized rarefactions within the structure. Close to this exostosis as well as close to the base of the first metacarpal, there are some areas of calcification half the size of rice grains and even smaller. Otherwise there are no demonstrable skeletal changes.

*Right wrist* (fig. 9): There is in some places a sharpening and in others a thickening of the joint margins of the wrist at the first carpo-metacarpal joint as well as light sclerosis of the wrist surfaces facing one another there.

Röntgen examination suggests an old comminuted fracture of the multangulum majus of the left hand with breaking away of a pea-sized fragment on the radial side as well as secondary deformative changes in the multangulum majus and adjacent part of the first metacarpal. Possibly there has also been a smaller fracture through the base of the latter bone.

There are signs of arthritis deformans in the first carpo-metacarpal joint of the right hand.

The patient was given a fixation splint and discharged $^{21}/_{10}$.

On examination $^{18}/_{3}$ 32 the patient reported that the left hand felt somewhat stiff and there were occasional grinding pains but otherwise no discomfort and there was no difficulty with the right hand.

*Status:* No tenderness over the bones of the left wrist. No swelling. Slight limitation of all the movements of the left wrist when compared with the right. At the base of the first metacarpal as well as in the anatomical snuff-box there can be felt a slight fullness like a prominence on the bone.

There is good strength in the hand and the patient can do her work as usual.

She cannot give any more details of the first fall but only remembers that she fell down a stairway and protected herself with her left hand.

In both of these cases there was a comminuted fracture of the multangulum majus. In the last case there was possibly a simultaneous fracture of the base of the first metacarpal.

The appearance of the fracture in fig. 1, 2 and 3 suggests that the blow was received in the long axis of the first metacarpal, which was in extension so that it acted like a wedge and split the multangulum majus. Bennett's, the typical boxer's injury, is the most common fracture of the first carpo-metacarpal joint and occurs when the fist is closed and the thumb receives a heavy blow.

For the comminuted fracture of the multangulum majus one can imagine a blow against the tip of the outstretched thumb or against the basal portion of the thumb during hyper-extension (subluxation) of the metacarpo-phalangeal joint. In both cases the first metacarpal is in extension and the direction of the blow falls in the long axis of the metacarpal bone.

It seems surprising that the naviculare is not injured with this fracture, when one sees fig. 2 and 3 and thinks that the effective force is in the long axis of the first metacarpal.

The *treatment* in both cases has been conservative with fixation of the thumb and wrist. The fixation bandage (plaster, wooden or metal splint with basal portion of the thumb included) and the length of treatment is the same as with fractures of the naviculare.

The *prognosis* in the first case cannot be stated since the patient cannot be found and only one year has passed since the injury. In the second case the patient is rather untroubled 15 years after the injury. She is able to do her work as wash and scrub woman, has only an occasional slight rheumatic pain in her hand and slight limitation of movement in the carpo-metacarpal joint. The fracture seems healed but there is a marked deformity of the multangulum majus and a deformative arthritis in the carpo-metacarpal joint.

## SUMMARY

After refering to JAEGER's 1931 review of the cases of fracture of the trapezium in the literature, the author reports two new cases of this relatively rare injury and attempts to explain the method of origin of the fracture.

## ZUSAMMENFASSUNG

Nachdem Verf. eine von W. JAEGER im Jahre 1931 gemachte Zusammenstellung publizierter Fälle mit Fraktur des Os multangulum majus referiert hat, teilt er zwei eigene Fälle dieser relativ ungewöhnlichen Schädigung mit und sucht die Entstehung der Fraktur zu erklären.

## RÉSUMÉ

Après avoir référé le résumé fait par W. JAEGER en 1931 sur des cas publiés de fracture sur l'os multangulum majus l'auteur cite deux cas à lui de ce mal relativement rare et cherche à expliquer l'origine de la fracture.

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# IV. INTERNATIONALER RADIOLOGENKONGRESS
## ZÜRICH 24.—31. JULI 1934 — MITTEILUNG No 3

Präsident:
Prof. Dr. H. R. SCHINZ

Generalsekretär:
Dr. med. H. E. WALTHER, Zürich, Gloriastrasse 14

Das detaillierte Programm wird den angemeldeten Teilnehmern des Kongresses im Laufe des Monats Februar zugestellt werden. Es enthält alle Angaben über Unterkunft und Reiseerleichterungen. Das Programm wird auf Wunsch auch denjenigen Mitgliedern radiologischer Gesellschaften zugestellt, die sich bisher nicht angemeldet haben.

WICHTIGE TERMINE:

**1. April 1934:** Letzte Gelegenheit zur Anmeldung von Referaten für die Diskussion und die Sektionsverhandlungen. Nur die bis zu diesem Datum eingereichten Résumés können in dem Sammelbande, der den Mitgliedern noch vor dem Kongresse zugestellt wird, Aufnahme finden.

**1. Juni 1934:** Letzter Termin für die Einsendung der Photographien und der personellen Angaben für das Porträtalbum.

**1. Juli 1934:** Letzter Termin für die Anmeldung als Teilnehmer des Kongresses. Meldungsschluss für die vom Kongress organisierten Reisen.

Es empfiehlt sich, die Hotelzimmer bis spätestens 1. Juli zu bestellen (siehe detailliertes Programm).

Alle Korrespondenzen sind zu richten an das Sekretariat des IV. Internationalen Radiologenkongresses, Gloriastrasse 14, Zürich.

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